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EDITED BY THURSTON SCOTT WELTON, M.D.

January 1942

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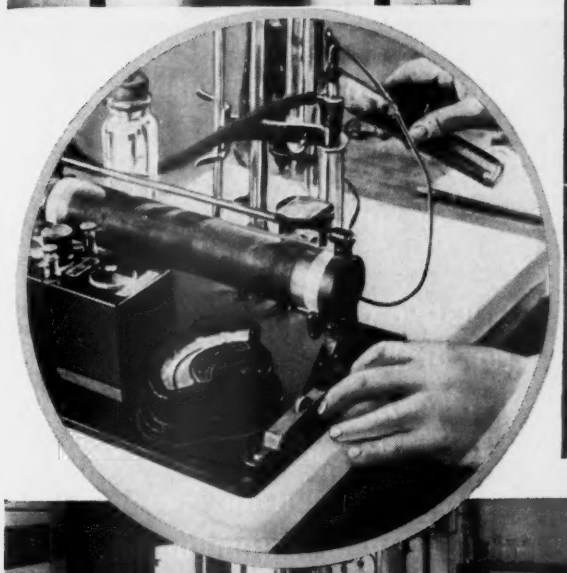

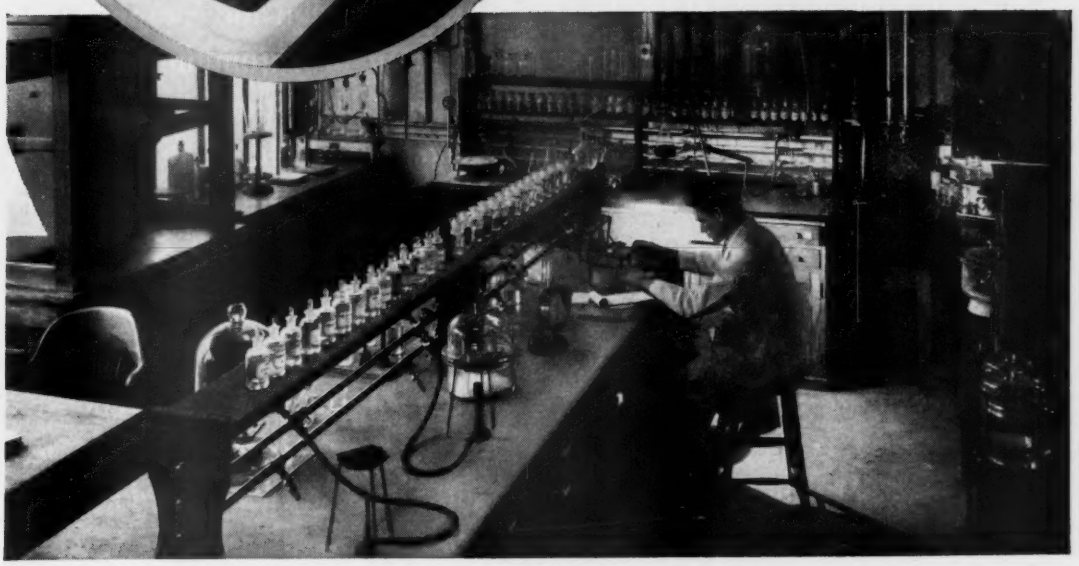

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Contents • January, 1942

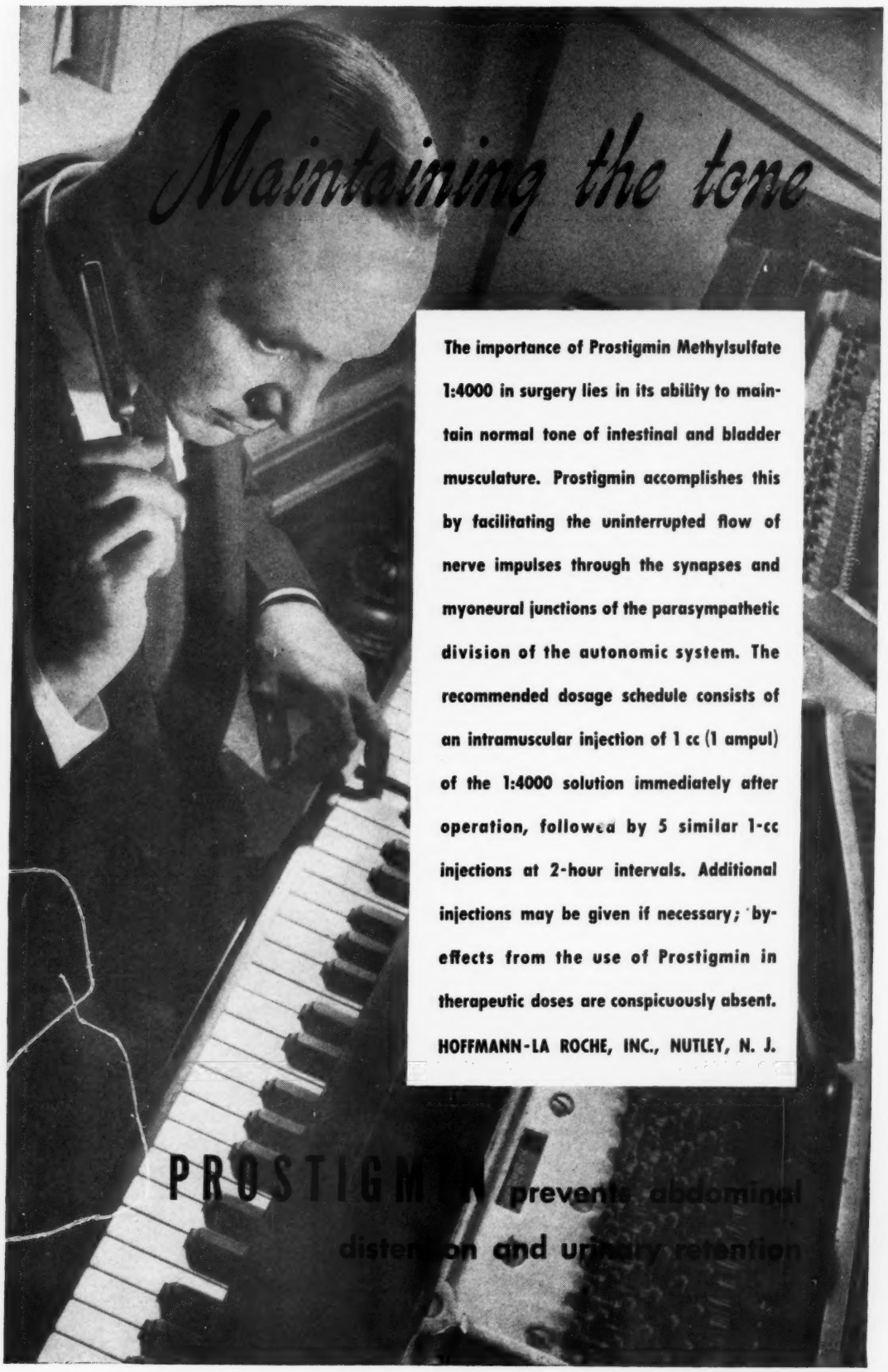
Editorials

Lest We Forget . . . . . *William Osler* 1
Medical Morals and Manners . . . . . T. S. W. 1

Original Articles

Pilonidal Sinuses. Review of the Literature and Report of Three Hundred Fifty Cases . . . . . *Henry P. Kooistra* 3
Mortality and Morbidity in Surgery of the Thyroid . . . . . *Chas. Gordon Heyd* 18
Operative Technic for Division of Renal Isthmus in Horseshoe Kidney . . . . *Robert Gutierrez* 28
Thyroidectomy . . . . . *Donald E. Ross* 37
Adrenal Apoplexy . . . . . *M. Jordan Thorstad* 44
Maintaining Reduction in Oblique Fractures of Long Bones *John P. Stump, Miles C. Krepela and Stanley F. Stockhammer* 49

Contents Continued on Page 3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Contents • January, 1942

NUMBER ONE

Diagnosis of Low Back Pain of Orthopedic Origin. An Analysis of Sixty-two Cases *Ernest A. Brav* 57
Malignant Synovioma of the Knee Joint . . . . . *Clarence H. Snyder* 67
Use of Pentothal Sodium for the Induction of Anesthesia in Thyrotoxicosis *Carroll H. Long, Abe Mickal and Alton Ochsner* 71
Delayed Metastases in Cancer of the Breast . . . . *Alexander J. Chilko and Henry Quastler* 75
Hypoxia—The Hazard of the Operating Room . . . . . *Douglass H. Batten* 83
Melanoblastoma. With Special Reference to Metastatic Dissemination *H. Harold Friedman and Max Lederer* 88
Choledocholithiasis . . . . . *J. Edward Berk* 96
One Hundred One Cases of Infections of the Face and Neck Following Oral Pathology . . . . . *Gerald R. O'Brien and Leonard R. Rubin* 102
Diagnosis and Localization of Intra-abdominal Abscesses by Roentgenological Methods . . . . . *Wm. C. Beck, John D. Koucky and Morton Baker* 113
Experiences with Spool Cotton as a Suture Material . . . . . *Phil Thorek* 118
Treatment and Cure of Seventy-six Cases of Hydrocele by One Twin-Injection of Lithium Salicylate and Quinine Hydrochloride and Urethane . . . . . *J. C. Diamond* 121
Surgical Treatment of Lupus of the Skin. Case Report . . . . . *Jacques W. Maliniac* 123
Economic Considerations of Cosmetic Surgery . . . . . *Robert O. Renie* 126
Treatment of Postoperative Parathyroid Tetany with Ovarian Hormones. Report of Two Cases . . . . . *David Kaplan* 131
Postpartum Appendicitis. Report of Two Cases . . . . . *Harris J. Timerman* 138
Regional Anesthesia for High Ligation of the Internal Saphenous Vein . . . *Caleb H. Smith* 141

Case Reports

Stab Wound of the Heart. Report of Two Cases in Which Suturing Was Successful *Robert E. Carter* 143
Experimental Sclerosis of the Gallbladder. Preliminary Report . . . . . *Dean Macdonald* 148
Paraffinoma of the Nose. Case Report . . . . . *George D. Wolf* 152
Incarcerated Pelvic Kidney Exhibiting Unusual Features . . . . . *Wilson Stegeman* 156
Acute Mechanical Ileal Obstruction Following Appendectomy *R. W. McNealy and Manuel E. Lichtenstein* 157
Primary Melanotic Sarcoma of Ovary . . . . . *Luther B. Otken* 160
Adenocarcinoma of the Rectum and Chromargentaffine Tumor of the Jejunum *A. M. Gnassi and H. P. Price* 163
Infiltrating Squamous Cell Epidermoid Carcinoma Involving the Os Calcis . *Ivor David Horwich* 166
Intestinal Perforation from Ingested Fishbone . *George H. Bunch, A. F. Burnside and L. J. Brannon* 169
Struma Ovarii. Case Report . . . . . *A. Lincoln Brown and Mervyn Shoor* 173
Large Ovarian Cyst in Newborn Child . . . . . *Jos. C. Bulfamonte* 175

New Instruments

New Gastrointestinal Suction-Irrigation Device . . . . *Jack Blaisdell and A. Ashley Rousuck* 177
Greater Descriptive Accuracy at the Operating Table . . . . . *Monroe A. McIver* 180
New Breech Forceps . . . . . *F. T. Brenner* 181
Useful Aid in the Management of Colostomies . . . . . *M. A. Slocum* 183

Bookshelf Browsing

Hugh Owen Thomas . . . . . *D. C. Patterson* 184

General Information on Page 4 *Advertising Index on 3rd Cover*

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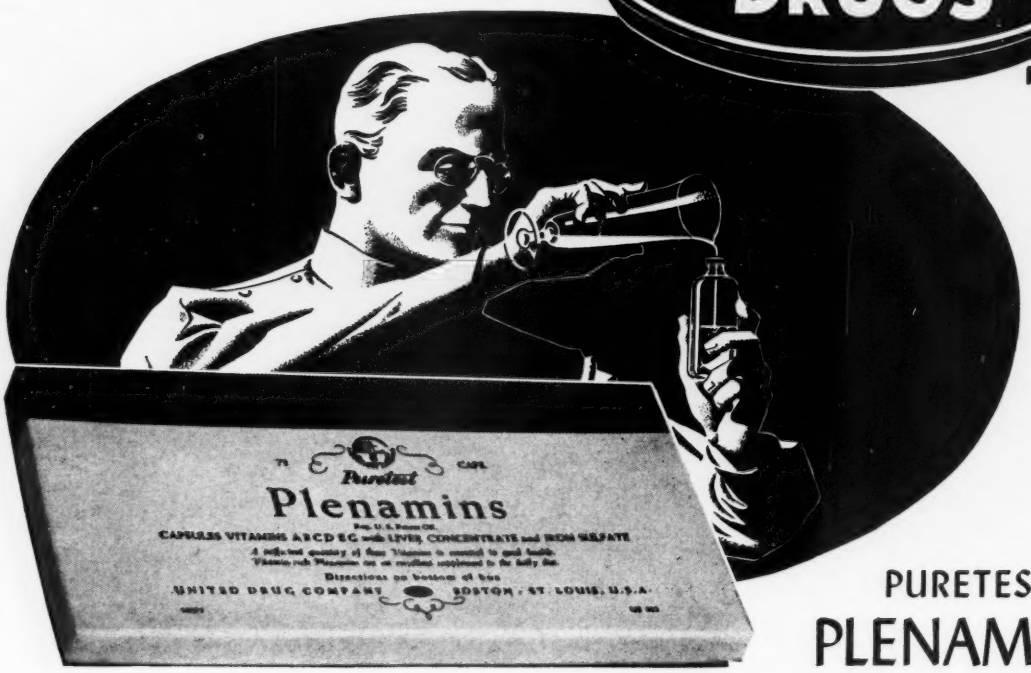

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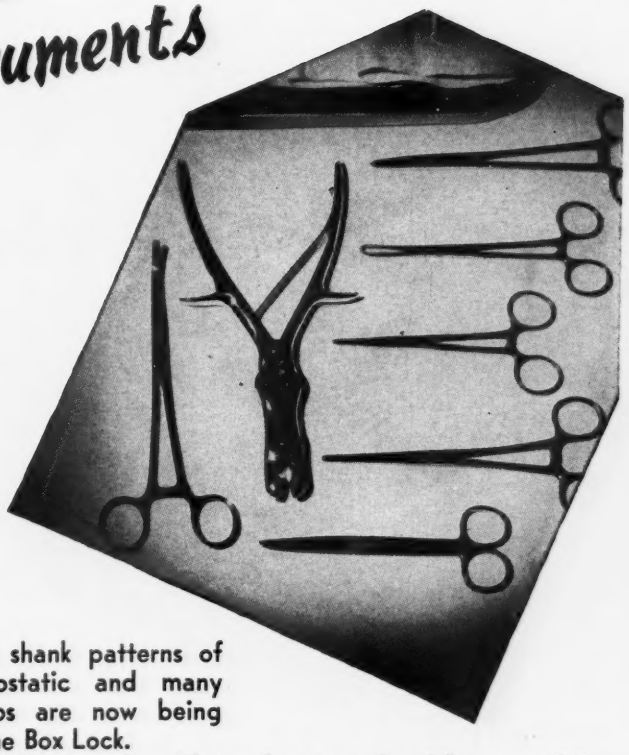

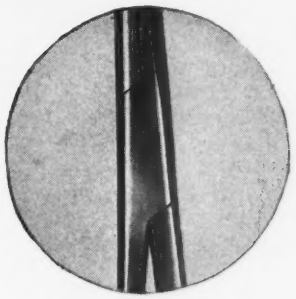

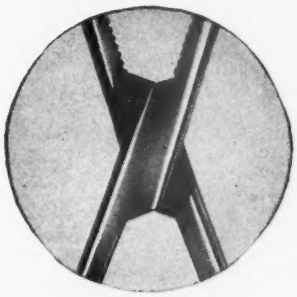

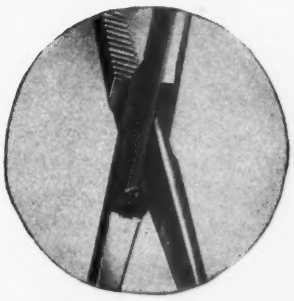

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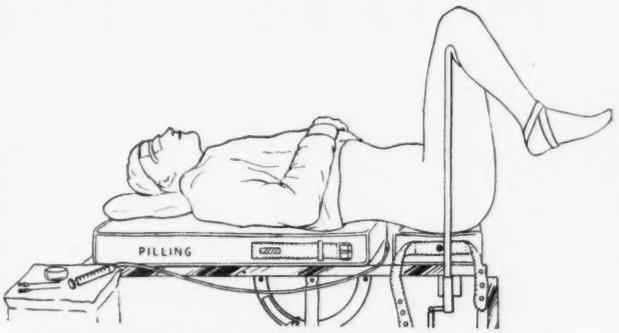

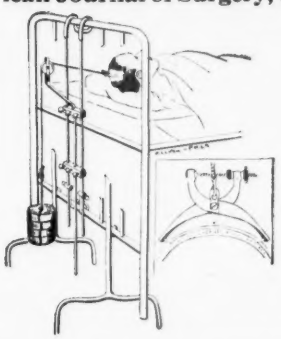

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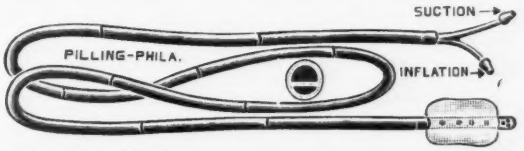

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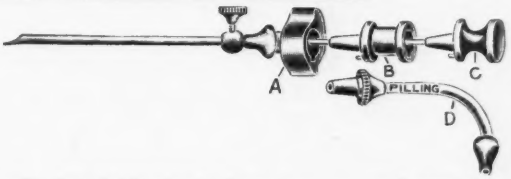

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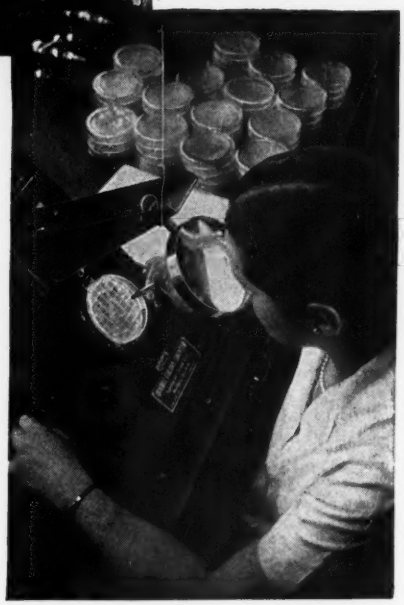

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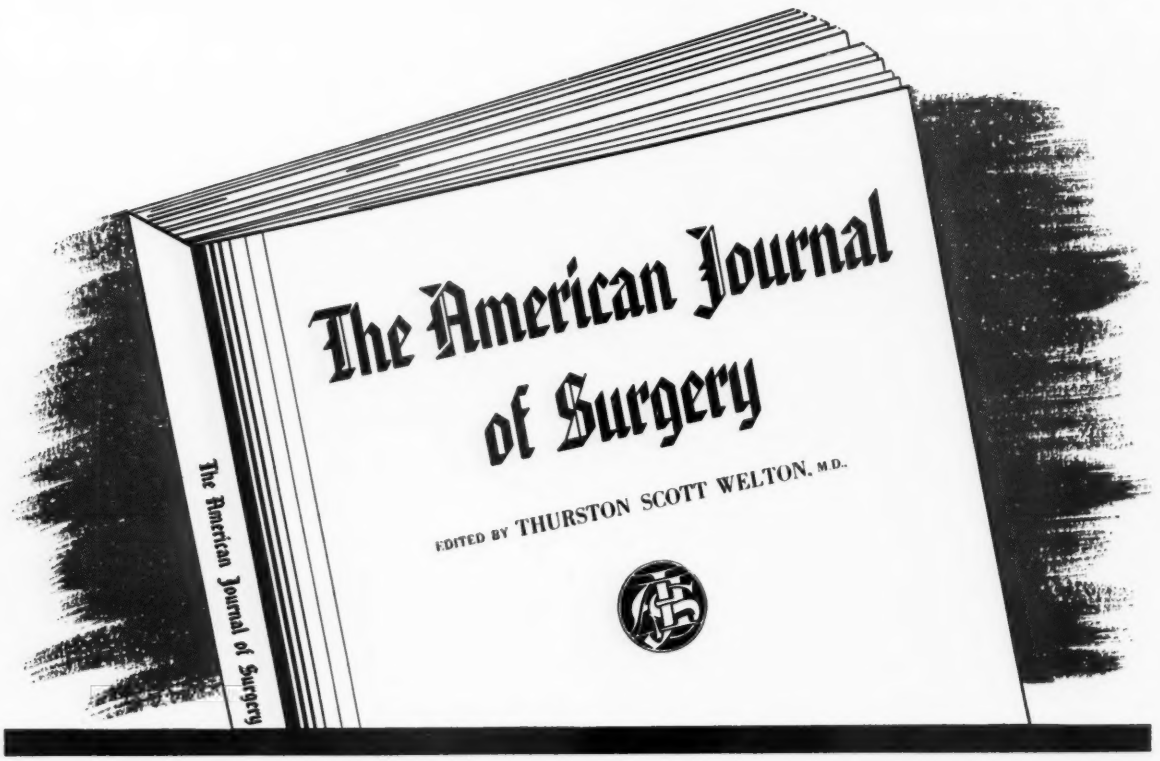

THE APRIL 1942

SYMPOSIUM

DIAGNOSIS IN SURGICAL CONDITIONS

Guest Editor, James T. Priestley, Mayo Clinic

350 Pages 100 Illustrations

THE LEADING INDEPENDENT SURGICAL JOURNAL

39 *Authorities have written for this* DIAGNOSIS SYMPOSIUM

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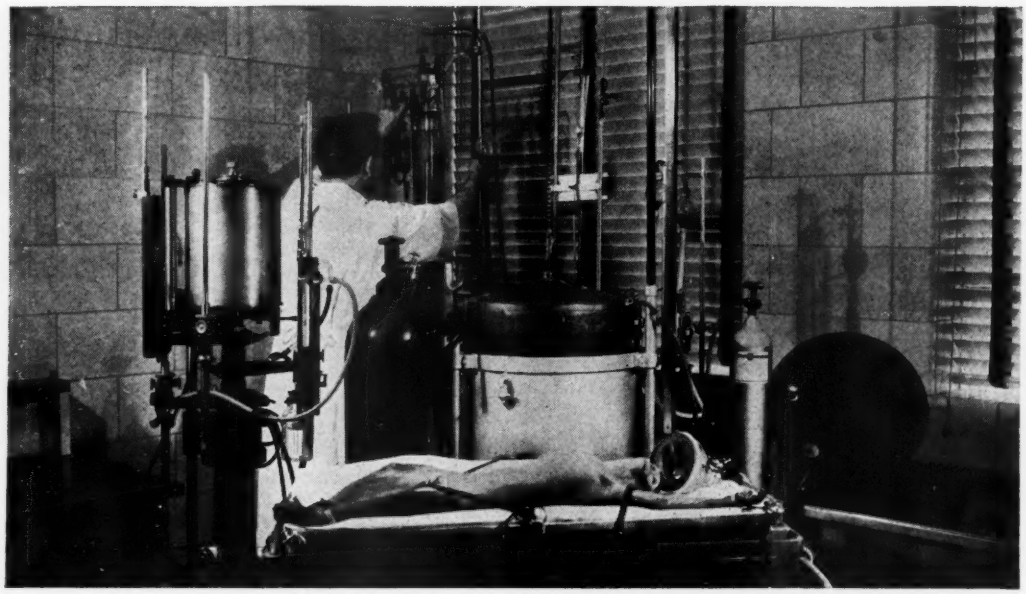

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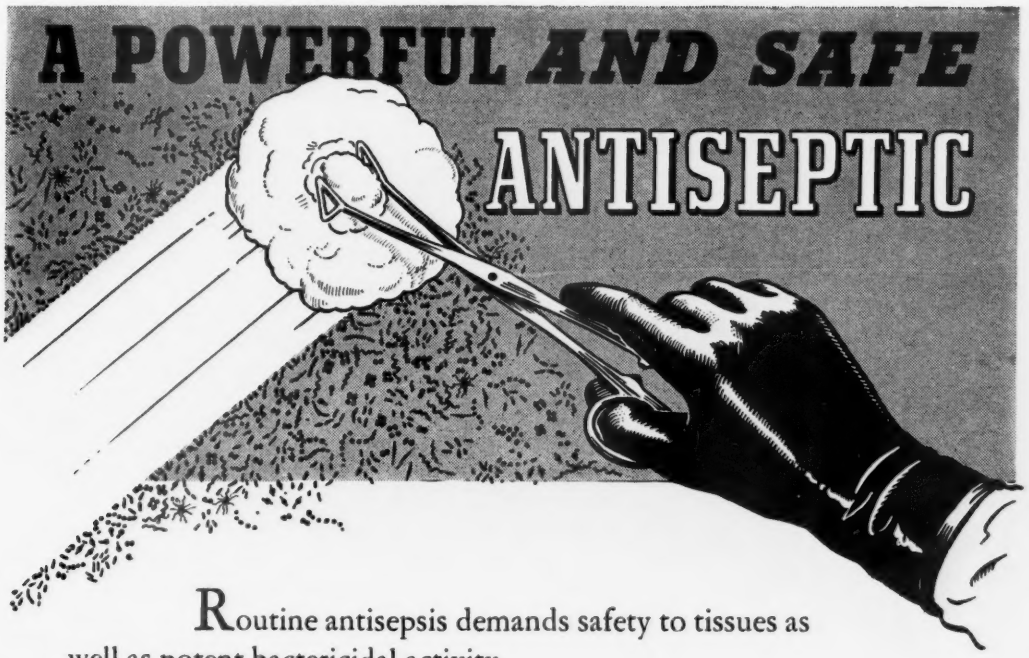

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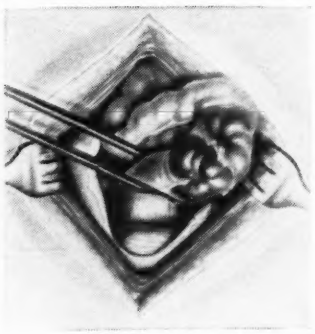
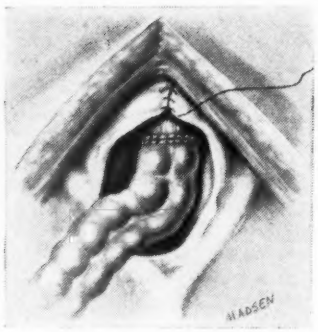


A. Resection of sigmoid colon.



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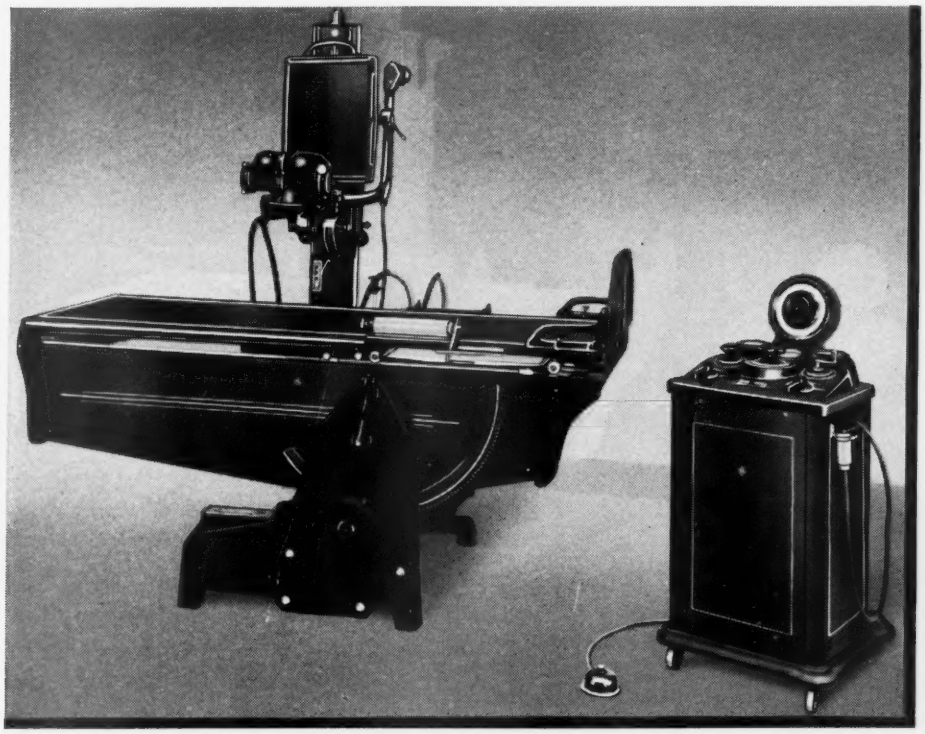

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NEW SERIES VOL. LV JANUARY, 1942 NUMBER ONE

Editorials

LEST WE FORGET

"WITH the hot blasts of hate still on our cheeks, it may seem a mockery to speak of this as the saving asset in our future; but is it not the very marrow of the teaching in which we have been brought up? At last the gospel of the right to live, and the right to live healthy, happy lives, has sunk deep into the hearts of the people; and before the war so great was the work of science in preventing untimely death that the day of Isaiah seemed at hand 'when a man's life should be more precious than fine gold, even a man than the gold of Ophir.' There is a sentence in the writings of the Father of Medicine upon which all commentators have lingered, *ἦν γὰρ παρή φιλανθρωπίη, πάρεστι καὶ φιλοτεχνίη*—the love of humanity associated with the love of his craft!—philanthropia and philotechnia—the joy of working joined in each one to a true love of his brother. Memorable sentence indeed, in which for the first time was coined the magic word *philanthropy*, and conveying the subtle suggestion that perhaps in this combination the longings of humanity may find their solution, and Wisdom—philosophia—at last be justified of her children."

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stand the shock and storm of every opposition. It has been beautifully compared to a star, whose light, though now and then obscured by a passing cloud, will shine on forever and ever in the firmament of heaven.'"

This is a good time to review again the above paragraphs from the pen of Hubert Ashley Royster, in "Medical Morals and Manners." The medical profession is going through rough waters. No doubt, while we strive to do our all during the coming months, some misguided zealot or narrow visioned clique with a half baked panacea for all our ills will attempt to push it down our throats by propaganda or legislation. In the long run only truth and the right will be victorious. Meanwhile Doctor Royster's wise counsel should be taken to heart.

To all who read these lines we wish a Happy, Healthy and Victorious 1942.

T. S. W.

Original Articles

PILONIDAL SINUSES*

REVIEW OF THE LITERATURE AND REPORT OF THREE HUNDRED FIFTY CASES

HENRY P. KOOISTRA, M.D.

Consultant in General Surgery, St. Mary's Hospital

GRAND RAPIDS, MICHIGAN

PILONIDAL sinuses present many varied problems to an interested surgeon. Though recognized for nearly a century, there still exists much confusion concerning them. The lesions are generally considered to be congenital, but their origin is not well understood or agreed upon. Clinically, they frequently go unrecognized or are misdiagnosed. There is no universally approved and accepted method of treatment and recurrences following surgery are common. Even the name, pilonidal sinus, does not meet with general approval.

The present study was undertaken to help solve some of the above problems. To accomplish this the following work was undertaken: a comprehensive review was made of the literature; serial sections of forty human embryos were studied microscopically; a detailed analysis was made of 350 case records; pathological sections of all excised tissues were microscopically examined, and a questionnaire study made primarily to determine end results in those cases in which the patients were treated.

Hodges[40] coined the term, "pilonidal" (*pilus:* hair; *nidus:* nest) in 1880, but since that time many names have been attached to this lesion. Some of the more common names are: sacral, coccygeal or sacrococcygeal infundibulum, dermoid and dermoid fistula, sinus, or cyst, posterior umbilicus, postanal dermoid, congenital dermal sinus and sacrococcygeal ectodermal sinus. Clinical usage has established the name pilonidal sinus or cyst over the others, notwithstanding the fact that this is a recognized misnomer, insofar as only about half of the cases present hair in the lesion.

REVIEW OF THE LITERATURE

Anderson,[1] in 1847, was apparently the first to call attention to this lesion when he reported on "Hair Extracted from an Ulcer." Warren,[100] in 1854, gave a good description of pilonidal sinuses and reported on three cases. Later he gave a more detailed description of the condition, advanced his ideas on etiology and outlined a course of treatment. Hodges[40] reviewed the previously reported cases, added one of his own and suggested the name pilonidal sinus.

During the last two decades of the last century considerable research work was done both here and abroad on the origin of these lesions. Outstanding among the pioneer workers in this field were Tourneaux and Herrmann,[95] Lannelogue,[55] and Mallory.[59] Further contributions were made by Féré,[26] Kuhn,[49] Tait,[92] Tertillion,[94] Courad,[17] and Wendelstadt.[103] In recent years the studies of Oehlecker,[66] Stone,[86] Fox,[29] and Gage[32] have been outstanding. During the past decade no less than fifty studies on this subject have been published in this country.

* From the Department of Surgery, University Hospital, Ann Arbor, Michigan.

Origin. The work of the investigators named above showed quite conclusively that pilonidal sinuses are congenital lesions. Prior to this, Warren[100] had suggested hairs becoming "inverted upon themselves in the follicle itself" as the etiological factor. Hodges[40] was among the first to assume its congenital origin. He considered three etiological factors as essential, namely, a congenital coccygeal dimple, abundant hair development and insufficient cleanliness.

Once anatomical study of numerous embryos by serial section had convinced research workers of the congenital nature of these lesions, two main schools of thought arose as to its etiology. The first,[107] as represented by Tourneaux and Herrmann,[95] and Mallory,[59] believed that pilonidal sinuses have their origin in a remnant of the medullary canal, and that the responsible factor is an abnormality in the development of the neural canal. The second school,[108] as represented by Féré,[26] maintained that pilonidal sinuses are due to an infolding of the surface epithelium or a faulty coalescence of the cutaneous covering in early embryonic life. Currently Gage[34] and Fox[29] hold these respective views, and present excellent articles on the same in some of the more recent literature.

Two other theories regarding etiology have been proposed. Stone,[87] in 1931, advanced the opinion that pilonidal sinuses resemble the preen gland found in certain species of birds and similar or analogous structures found in certain species of reptiles and mammals. More recently Kallet[44] advanced the concept that pilonidal sinuses represent growths derived from an embryonic remnant of a vestigial secondary sex gland located in the sacrococcygeal region. Neither of these theories has found wide acceptance.

EMBRYOLOGIC STUDIES

An evaluation of the above theories was attempted through a study of serial sections on forty human embryos. These embryos, all from the University anatomical laboratories, ranged in size from 4 to 180 mm., crown-rump.

To understand these theories a knowledge of embryonic development is essential.[46,51] In the normal young embryo following the appearance of the primitive streak, a fold of tissue appears on each side of the streak. These are known as the medullary folds and between them lies the so-called medullary groove. The medullary folds gradually grow in height, and as the groove between them deepens, these folds meet and gradually fuse along the midline. The medullary groove has then become the medullary canal. It is surrounded by the primitive nerve cells of the medullary or neural tube and represents the central nervous system of the full term fetus. This tube gradually becomes separated from the overlying cutaneous covering by a rapid ingrowth of mesodermal cells. The caudal end of the neural tube is prominent by the end of the first month of intrauterine life, but thereafter undergoes a progressive atrophy. (Figs. 1, 2, and 3.) Normally, it completely disappears by the time of birth.

In our study on embryos the findings of Mallory,[59] Tourneaux and Herrmann[95] and Gage[32] were corroborated. A remnant of the medullary canal was found overlying the coccyx in all the embryos examined. (Figs. 1, 2, and 3.) In the larger embryos this invariably assumed the character of a cyst-like space, lined by cells seen lining the central canal of the spinal cord. (Fig. 3.) As a rule this cyst-like structure was well separated from the skin, but in a few specimens it was found to lie very close to the skin. During the second half of fetal life, these cyst-like structures were seen to undergo a gradual atrophy, becoming not only smaller in size, but also showing a tendency to be replaced by connective tissue.

Evidence favoring the theory that pilonidal sinuses have their origin in surface epithelium defects was also found. Many of the embryos studied showed a marked

irregularity of the surface epithelium of the coccygeal region. (Fig. 3.) A few of the fetuses actually showed a marked invagination of the epithelium, similar to the cases described by Fox.[29] Incidentally, it was noted that the surface epithelium of the caudal region was frequently quite devoid of hair follicles, sebaceous glands and sweat glands. In no case did the cells lining the cyst-like structures described in the paragraph above, resemble the squamous cells of the surface epithelium. (Fig. 3.) Finally, the theories of origin dependent upon the existence of abnormal gland tissue were not corroborated as no evidence of such tissue was found.

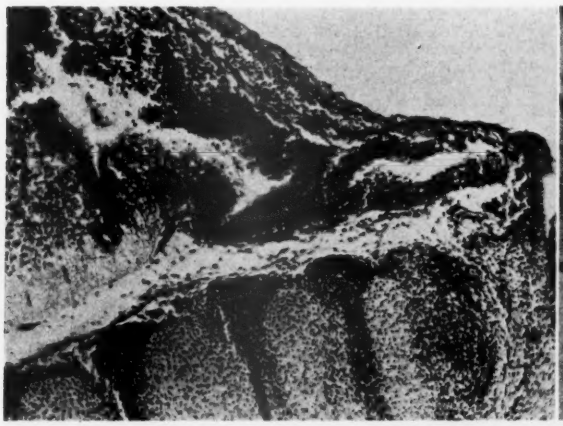

Fig. 1. A midline sagittal section through the caudal region of a very young embryo. Along the inferior margin the terminal coccyx may be seen. Between this and the cutaneous epithelium seen along the superior margin is a large mass of dark staining tissue with an irregular channel coursing through it. This represents the canal in the medullary tube. Figure 2 demonstrates the subsequent atrophy of this tissue. In Figure 3 only a small, cyst-like space remains.

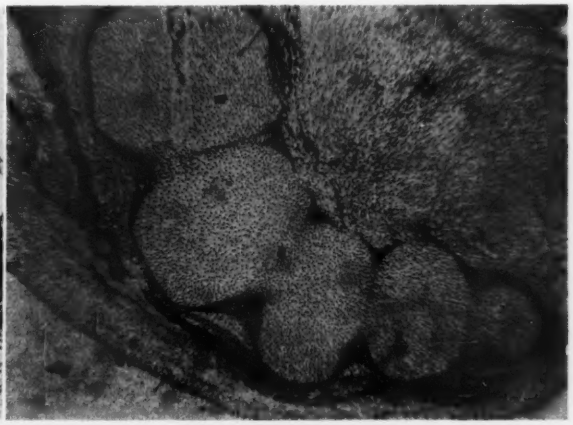

Fig. 2. A sagittal section of a 39 mm. (C.R.) embryo showing the atrophied remains of the medullary tube and canal overlying the lower sacrum and coccyx. The canal can still be traced to the last segment of the coccyx where a cystic space appears.

From these findings no conclusive opinion seems justifiable. It is to be hoped that further study, particularly of serial sections of young embryos demonstrating pathological conditions in this region, will eventually disclose the exact origin of this lesion. Such a study is now being undertaken.

GENERAL CONSIDERATIONS FROM CASE RECORD STUDIES

Pilonidal sinuses are considerably more common than is generally supposed.[12,28,70] During a fourteen-year period covering 313,285 admissions to the University Hospital, a diagnosis of pilonidal sinus was made in 350 cases, seventeen of which were recurrent lesions. This is an incidence of approximately 1:940.

The lesion is most commonly found in patients ranging from twenty to twenty-five years of age.[109] In this series, the average age was twenty-five years at the time of admittance. The average duration of symptoms prior to admittance was three and one-half years, hence the average age at the onset of the lesion was twenty-one and one-half years. A sudden incident rise was noted at the age of seventeen, which reached a peak at age nineteen, and remained high through the age of twenty-five. Fifty-eight per cent of the cases occurred in this age group, a finding which may in part be explained by the fact that about 30 per cent of the cases occurred among University students. After twenty-five years of age there was a definite and maintained drop in incidence. The oldest patient was sixty-seven years of age, the youngest a newborn infant.

Pilonidal sinuses are more common in males. Of the 350 cases, 258, or 73.7 per cent, occurred in males; 92 cases, or 26.3 per cent, occurred in females. This is in agreement with the findings usually re-

ported,[110] although Newell[65] showed a predominence in females. No adequate explanation for this observation has ever been offered. Conceivably, the amount of body hair might be a factor, males generally having more than females. Most men[54,69] are of the opinion that this lesion is most common in individuals having an excessive amount of body hair. However, the sinus is often seen in individuals not of this habitus.

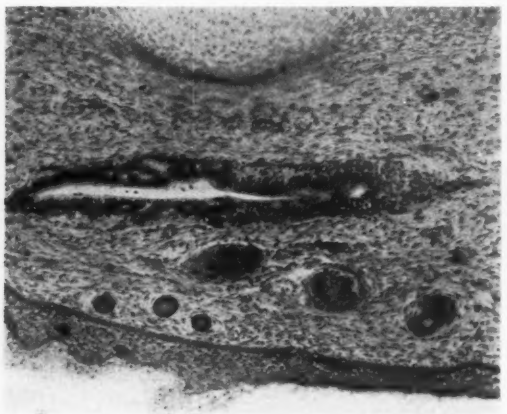

FIG. 3. A midline sagittal section of 160 mm. (C.R.) embryo showing the cyst-like remains of the medullary canal which overlies the coccyx. The epithelial cells lining this cyst cavity differ markedly in both structure and arrangement from those seen on the surface skin. There is a marked irregularity of the surface epithelium.

A correlation between the age and sex incidence shows that females develop symptoms of this lesion earlier in life than the males. While 40 per cent of the females were under twenty years of age, only 19 per cent of the males were in this age group. (Table I.) This fact, not previously reported, apparently has an etiological significance. Since the human female reaches puberty earlier in life than does the male, it appears that these lesions are stirred on to activity by the sex hormones. The rôle these hormones play in regulating body growth in general and, particularly, growth in body hair and secondary skin structures, is well recognized.

It is apparently a well established fact that this disease is strikingly restricted to the Caucasian race,[69] and our findings tend to confirm this view. Occasional cases have been reported in negroes.[12,25,45,76,81] One of the patients in this series was a negress. No cases have been reported occurring in a member of the brown, yellow or red race. Why this should be the case is also unexplainable at the present time, although it is probable that no systematic study of sufficient numbers of these peoples has yet been undertaken.

An analysis of the nationality of the patients showed no correlation with the occurrence of pilonidal sinus. Likewise, there was no apparent correlation with the type of occupation.

A questionnaire study of the family history in one hundred representative cases revealed a hereditary factor in 10 per cent. Of these, one patient reported a similar lesion in his father, one in a cousin, seven in a brother and one in both a brother and sister. Although some authors[12,28] deny a hereditary factor, there have been many reports of a positive familial history for this anomaly.[111] Stone,[86] in his original article, cited a father and his two sons who were afflicted with pilonidal sinuses. A similar case has recently been called to the author's attention. Kallet[44] reported a case in which two brothers and one sister had this lesion. Mechling,[61] and more recently, Goldberg and Bloomenthal,[36] have reported the presence of these lesions in identical twins. These facts definitely point to an hereditary etiological factor and indicate an "anlage" for this defect in the very earliest stages of embryonic development.

By means of the questionnaire, it was also determined that 32 per cent of the cases gave a definite history of trauma, usually either a fall or a blow. (Table II.) Analysis disclosed, however, that in only 14 per cent did the trauma occur within a month of the onset of symptoms. In nearly half of the cases, the alleged injury occurred from one to ten years previously. It seems unlikely that any injury occurring more than one month prior to the onset of symptoms could be considered as an

aggravating factor. On this basis 86 per cent of the patients presented no history of significant injury. Although contrary to the generally accepted view,[112] it seems justifiable to conclude that direct trauma plays a comparatively minor rôle in the etiology of pilonidal sinuses. Weinstein,[101] and Breidenbach and Wilson[12] share this view. Indirect trauma such as friction incidental to sitting, or the irritation of clothing, is thought to play an etiological rôle by Zieman.[106]

TABLE I

INCIDENCE IN RELATION TO SEX AND AGE

	Age in years	0 to 5	6 to 10	11 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 & over	Total
MALES	No. of cases	7	0	2	60	103	31	25	7	13	10	258
	Per cent of total	2.7	0.0	0.8	23.2	40.0	12.0	9.7	2.7	5.0	3.9	73.7
	Cumulative per cent	2.7	2.7	3.5	26.7	66.7	78.7	88.4	91.1	96.1	100	
FEMALES	No. of cases	7	0	3	31	23	12	5	6	2	3	92
	Per cent of total	7.6	0.0	3.3	33.7	25.0	13.0	5.4	6.6	2.2	3.2	26.3
	Cumulative per cent	7.6	7.6	10.9	44.6	69.6	82.6	88.0	94.6	96.8	100	

Average age of group..... 24.9 yr. (350 cases)
Average age of males..... 25.47 yr. (258 cases or 73.7 per cent)
Average age of females..... 23.26 yr. (92 cases or 26.3 per cent)

A study of associated and incidental diseases proved interesting. Kallet[45] recently suggested that the pituitary gland may play a rôle in pilonidal sinus development, but there was only one case of pituitary disease (acromegaly) recognized in this series. Johnson and Livingston,[42] have reported a high incidence (3.4 per cent) in a study of 1,000 mental defectives; but in our series there were only four cases (1.2 per cent) with associated mental disorders. Associated congenital defects were recognized in six patients (1.8 per cent) with skeletal abnormality, (four were spina bifidas), and there were four cases (1.2 per cent) with inguinal hernias. Diabetes, a disease often associated with slow healing lesions, was found in but four cases (1.2 per cent). There were six cases (1.8 per cent) of pulmonary tuberculosis, and one case (0.3 per cent) of bone tuberculosis. Only three patients (0.9 per cent) had syphilis. Apparently, pilonidal sinuses do not play an active rôle as foci of infection. There were seven cases (2.1 per cent) with an associated hypertension, three cases of nephritis (0.9 per cent), three cases of arthritis (0.9 per cent) and two cases of furunculosis (0.6 per cent).

CLINICAL MANIFESTATIONS

Symptoms. The average duration of symptoms from the onset until the time of admission was thirty-eight months for this series. The duration of symptoms varied directly with the age of the patients. Thus, the average duration in patients under twenty years of age was sixteen months; in patients from twenty to thirty years of age, it was thirty-eight months; while in those over thirty years of age it ranged from five to twenty years or more. (Table III.)

There is a general agreement as to the signs and symptoms produced by pilonidal sinuses and the findings of this series are

typical. (Table IV.) Two symptoms were outstanding, namely, pain in the sacrococcygeal region and discharge. Pain was present in 84 per cent of the cases. The pain was usually mild, gnawing in character with exacerbations and remissions being common. Often there was only discomfort on sitting. The exacerbations were associated with recurrent infection and abscess formation. In several female patients the pain was worse at the time of the menses, a fact which may be explained on a hormonal basis but more likely was due to irritation from a sanitary belt. A history of a discharge was present in 78 per cent of the cases. This was usually watery, colorless or creamy and minimal in amount, producing only a light soiling of the clothing. In three cases the discharge was blood-tinged, in two of these for prolonged periods. Rarely was a patient seen complaining only of an unexplained discharge or a painless swelling in this region. Chills and fever were rarely noted.

The presenting complaint was usually "a boil over the end of the spine." Many times this was a recurrent lesion. It was this history of recurrent abscesses in the sacrococcygeal region which was almost diagnostic.[81]

TABLE II
INTERVAL BETWEEN INJURY AND ONSET OF TROUBLE

	No. of Cases	Per cent of Trauma	Per cent of Total Cases
One day to one week	10	31	10
One week to one month	4	13	4
Six months to one year	6	19	6
One year to two years	2	6	2
Three years through five years	3	9	3
Five years to ten years and over	7	22	7
Totals	32	100	32

TABLE III
DURATION OF SYMPTOMS PRIOR TO ADMISSION

	No. of Cases	Per Cent of Total
Within one week	6	2.1
Two weeks to one month	13	4.7
One to three months	17	6.5
Three to six months	30	10.8
Six months to one year inclusive	46	16.6
One to two years	40	14.5
Two to four years	50	18.1
Five through eight years	42	15.2
Eight through twelve years	19	6.9
Thirteen to twenty years	10	3.6
Twenty-one to twenty-six years	3	1.0
Totals	276	100

TABLE IV
SYMPTOMS

	No. of Cases	Percentage of Total
1. Tumor and pain	27	9
2. Tumor, pain and discharge	151	51
3. Pain only	11	4
4. Pain and discharge	56	18
5. Discharge only	27	9
6. Chills and fever and painful mass	5	2
7. Tumor only	3	1
8. Itch only	3	1
9. Symptomless	16	5

Total number of patients with pain 250 (84 per cent).
Total number of patients with discharge 234 (78 per cent).

TABLE V
PREVIOUS OPERATIVE PROCEDURES
(117 Cases)

	No. of Operations in Outside Hospitals		No. of Operations in This Hospital		Total Operations
	I and D	Excision	I and D	Excision	
Previous operations in outside hospitals	118	22	..	..	140 (83 cases)
Previous operations in this hospital only	...	..	18	10	28 (23 cases)
Previous operations both inside and outside	16	3	9	5	33 (11 cases)
Totals	134	25	27	15	201

Of the 202 patients who underwent treatment at the University hospital, 117 (58 per cent) had undergone previous operative procedures, four out of five of these elsewhere. (Table v.) A single previous incision and drainage had been carried out in forty-nine cases, and two to four previous incisions and drainages in forty-four cases. A single previous excision had been performed in thirty cases, and two previous excisions in five cases.

TABLE VI
SIGNS

	No. of Cases	Percentage of Total
1. Abscess and sinus (es)	81	26
2. Dimpling only	8	3
3. Dry sinus (es)	48	15
4. Sinus, discharge and hair	10	3
5. Discharging sinus (es)	143	46
6. Swelling only	14	5
7. Inflammation and tenderness	3	1
8. Scarring only	3	1

Signs. Two outstanding signs were abscess formation and the presence of a sinus in the sacrococcygeal region. (Table VI.) Abscesses occurred in 70 per cent of the cases. These varied considerably in size ranging from ½ to 15 cm. in the longitudinal direction. They were usually found in the deeper soft tissues overlying the coccyx and lower sacrum. The presence of one or more associated midline sinuses proved diagnostic.

Sinuses were found in 90 per cent of the cases studied. (Table VII.) Four out of five of these were single and occurred in the midline, 2 cm. or more above the anus. The remaining cases showed multiple sinuses, either in the midline only, or associated with lateral sinuses (10 per cent). The midline sinuses were, as a rule, not indurated, and had an epithelial lining. The lateral sinuses, were twice as common on the left side, and unlike the midline sinuses they showed a border of granulation tissue. Often there was an associated discharge which was usually seropurulent in character. In an occasional case hair was seen protruding from the sinus. On probing, the sinuses were invariably found to run cephalad and usually they communicated with the abscesses. Multiple sinuses were commonly found to communicate with the same cavity, although occasionally they apparently communicated with separate cystic cavities. In about 10 per cent of

TABLE VII
PILONIDAL SINUSES (282 OUT OF 310 CASES—90 PER CENT)

	No. of Cases	Per Cent of Total
One midline sinus only	227	80
Multiple midline sinuses only (one to five in number)	31	11
Lateral sinuses along with midline sinuses (one to five in number)	24	9
a. One lateral sinus with one to five midline sinuses (21 cases)		
b. Two lateral sinuses with one to two midline sinuses (3 cases)		
Totals	282	100

Twenty-eight cases presented no apparent sinuses (10 per cent).

TABLE VIII
OPERATIVE PROCEDURES

Treatment Used	No. of Cases Treated	Average Number of Days in Hospital	Percentage of Treated Cases	Percentage of Excision Cases
Incision and drainage	30	4.3	15.0	
Incision and drainage plus sclerosing solution	3	4.3	1.5	
Excision and packing	39	10.3	19.3	23.1
Excision, partial closure and packing	21	11.6	10.3	12.4
Excision and primary closure	42	10.1	20.7	24.8
Excision and closure plus drainage	64	10.6	31.7	37.9
Excision and closure with later open packing	3	14.0	1.5	1.8
Totals	202	9.5	100.0 (202 cases)	100.0 (169 cases)

the cases there was no sinus demonstrable —true pilonidal cysts.

It is rare that a sinus occurs at a spinal level higher than the sacrococcygeal. When this occurs the lesion is serious insofar as the sinus then commonly communicates with the spinal canal. Fourteen of such cases have been reported.[113] Infection of these sinuses usually results in signs and symptoms of either a meningitis or a subdural abscess. One case in the present series, previously reported by the author,[48] occurred over the third dorsal vertebra and presented the signs and symptoms of a cord tumor. At operation the lesion was found actually to invade the spinal cord.

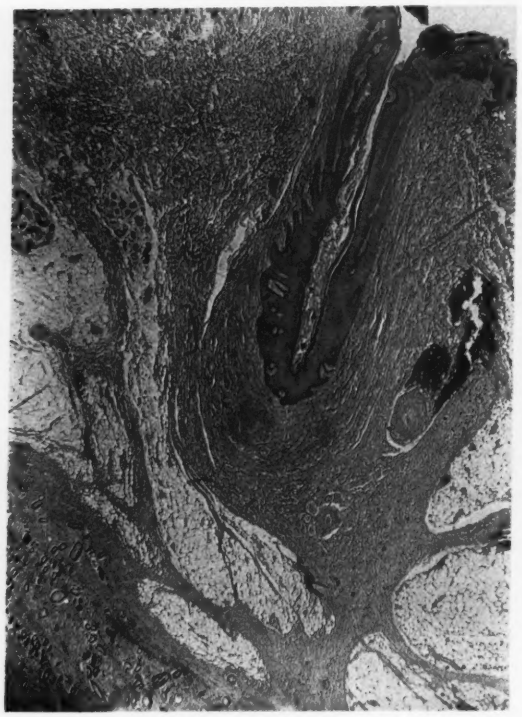

FIG. 4. Microphotograph of a typical pilonidal sinus. The epithelium lining the sinus is well preserved, and opens on to the skin surface in the upper right hand corner. In the lower left hand corner is seen granulation and scar tissue with a great many dead hairs embedded in it. This represents the deeper cystic portion of the sinus which has completely lost its original epithelium.

Laboratory Procedures. Routine blood studies were usually of little value. Leucocytosis was observed only in case of acute abscess formation. There were only eighteen cases with a white blood count over 10,000 and the average for this group was 14,300. No significant findings were made on urinalysis. Bacteriological examination of the discharge was carried out on only five cases. The cultures showed Streptococcus hemolyticus and Staphylococcus aureus in two cases, Streptococcus hemolyticus and a diphtheroid in one case, Streptococcus non-hemolyticus in one case, and a Gram-negative coccus in one case.

FIG. 5. Microphotograph of a pilonidal sinus demonstrating its branching. Two cyst spaces lined by epithelium are seen, and in succeeding sections these fused. Much scar tissue and inflammatory reaction is noted about the cyst spaces. Dead hairs are found lying within both the sinuses and in the epithelium proper of the cyst to the right.

Roentgen examination following the injection of iodized oil into the sinus was resorted to in several cases. This was used to determine the extent, direction and communications of the sinus tract in certain complicated cases.

PATHOLOGY

A microscopic examination made on 170 specimens removed surgically revealed much interesting data. The sinus or sinuses usually communicated with a deeper por-

tion which showed a cystic dilatation, and the whole structure was lined by a stratified squamous epithelium. (Fig. 4.) Not infrequently the sinuses appeared to be branched, and ramifications of the irregular cyst surface were noted. (Fig. 5.) Infection and inflammation are generally noted on pathological examination.[39,41,60] The sections of this series were no exception and showed polymorphonuclear leucocytes, lymphocytes and plasma cells in varying proportions. As a result of the infection much of the lining epithelium of the cystic part was destroyed, and granulation tissue and scar tissue was seen replacing it. Occasionally, small islands of regenerating epithelium were seen. Hair was found in the cystic cavity or in the granulation tissue in eighty-nine of the sections studied (52 per cent). Usually the hair was dead and of a fine texture, but hair follicles were noted in fifteen cases (9 per cent), most commonly on the sinus proper. Because some authors[12,32] deny the presence of sebaceous and sweat glands in the deeper tissue, a careful search was made for the same. Sebaceous glands definitely related to the cyst or sinus were demonstrated in five of the tissues studied (Fig. 6); sweat glands thought to be related to the lesion were also seen. Granulation tissue devoid of epithelium, hair or accessory skin structures was seen in sixty-six cases (39 per cent). Foreign body giant cells, indicating tissue reaction, were seen in 44 per cent of the cases. These were most commonly found in the granulation tissue, frequently about dead hairs and on a few occasions about old suture material.

A study made of the pathological sections of those cases in which two or more excisions were done proved of interest. Of twelve cases examined all but one demonstrated typical pilonidal sinus tissue. In nine of the remaining eleven cases, dead hair was found in the granulation tissue removed from within the wound. This is interpreted to indicate incomplete removal of the lesion at the time of the first operation.

A careful study of all the available sections failed to reveal any trace of glial tissue or embryonic nervous tissue remains.

Fig. 6. Microphotograph of a fairly well preserved pilonidal sinus showing a minimum amount of infection. To the left a typical hair follicle with an associated sebaceous gland is seen, while on the extreme right, further sebaceous gland tissue associated with the same sinus is noted. Two arrows have been placed to indicate these areas. Within the sinus proper, some epithelial débris and a few dead hairs are seen.

Gage[30] reports its presence in one case and ascribes great significance to it etiologically.

DIAGNOSIS

The diagnosis of pilonidal sinus is usually not difficult. The history of recurring pain and discomfort in the sacrococcygeal region, frequently with a discharge, is very suggestive. The presence of a lump or abscess in this region should call to mind this lesion. A careful search will usually reveal one or more characteristic midline sinuses lined by epithelium, and varying in size from 1 mm. up to 1 cm. or more in diameter. Hair will occasionally be seen protruding from the sinuses. One or more lateral sinuses may also be noted, but these will be lined by granulation tissue. Discharge from any or all the sinuses is common. Finally, it should be noted that the midline sinuses course a cephalad direction when probed.

In a differential diagnosis a number of pathological conditions must be considered. Fistula-in-ano can be recognized by the caudad direction of its sinus when

probed and by identifying the mouth of the sinus on rectal examination. Furuncles, boils and carbuncles neither give the prolonged history nor that of repeated attacks at a given site; they do not have epithelial sinuses and usually lie more superficially. Plugged sebaceous follicles likewise are also more shallow. Osteomyelitis, tuberculosis and syphilis should be ruled out through history, serology tests and *x*-ray examination. Traumatic dermoids and implantation cysts should be differentiated by a careful history and physical examination. Chordomas, terratomas, fetal adenomas and other neoplasms may have to be considered. If a careful history and physical examination with *x*-rays do not differentiate them, a biopsy should be taken. In rare cases roentgenograms, taken after the injection of an iodized oil, will prove most helpful diagnostically.[2,11,69,78]

TREATMENT

It is obvious from pathology that any form of treatment, to be successful, must completely eradicate the cyst or sinus and all the granulation tissue. Furthermore, it must control the infection during the process of healing. There still exists a great diversity of opinion as to how this may best be accomplished, and no single method of treatment has proved satisfactory. Unsatisfactory end results, usually due to either delayed healing or a recurrence of the lesion, remain a problem.

Many ambulatory methods of treatment have been suggested. These generally aim to destroy the diseased tissue either through the medium of chemicals or by means of electrical currents. Anderson[2] injected chloride of mercury. Crookall[18] used caustic silver nitrate. Cutler and Zollinger,[20] and later Block and Greene[8] report on the efficacy of a modified Carnoy's solution. Recently Biegeleisen[6] introduced fuming nitric acid. Maillard[58] first used electricity to effect a cure. Rogers and Hall[75] and more recently Rogers and Dwight[74] have reported gratifying results in two large series of cases treated by excision with cautery followed by open packing.

The great majority of surgeons favor hospitalization in the treatment of this condition. Incision and drainage is generally considered the treatment of choice in cases showing acute infection. Excision is advised when the infection has subsided. Lahey,[52] Cattell,[13] Ferguson,[28] Colp,[16] Horsley,[41] and others[91,104] have advised special technics of primary closure. A large group of men prefer excision and primary closure.[114] Some men advocate primary closure with a drain, and La Rochelle[56] has advanced a special technic for this. Weeder[102] suggests this method of treatment but believes that in selected cases the coccyx should be removed to obviate recurrence. Probably the great majority of surgeons[115] believe that excision and packing of the wound, either with or without partial closure, constitutes the treatment of choice for most cases.

Analysis of Treatment in This Series. Treatment was rendered in 202 of the 350 cases diagnosed. A general anesthetic was used in the great majority (over 90 per cent) of these patients, while a spinal agent was used on only two patients. Local infiltration was used in eleven of the more simple procedures. There were no anesthetic or surgical deaths.

An analysis of the operative procedures used is seen in Table VIII. Incision and drainage, one or more times, was employed in all cases showing acute infection. It was used on thirty cases not only to afford the patient relief but also to prepare the case for subsequent curative surgery. Carnoy's solution was used in three additional cases having only incision and drainage. The results with it were encouraging, but the method was not given a sufficient trial to warrant a full evaluation of this type of therapy. Its use in the less complicated cases seems desirable.[8,20,81,98]

Excision of the lesion was employed in 169 cases. Closure of the wound, either with or without drainage, was limited to the more mildly infected cases (63 per

cent), while the remainder were "packed open," some with partial closure. A colored solution, such as methylene blue, was used preoperatively in sixty-three of the cases. On twenty occasions the excision was done with a cautery knife. Most of the excisions were accomplished by means of an elliptical incision over the diseased area, although special technics were resorted to occasionally. Obliteration of all "dead space" was considered to be of the greatest importance in all wounds that were closed. If this was not feasible, the wound was treated by this was used in conjunction with other treatment in two cases. No advantages, other than relief of discomfort, could be demonstrated from any of these procedures.

The average stay in the hospital (Table VIII) for the group treated by excision was ten and one-half days; the patients treated by primary closure averaged 10.4 days, compared to 10.7 days for the "open" group. It was noteworthy that the patients on whom either methylene blue or cautery was used required 11.3 days hospitalization, as compared to 9.8 days for those on

TABLE IX

END RESULTS FOLLOWING EXCISION

(Answers per Questionnaire Method)

Type of Treatment	Total No. of Cases	Days from Work*	Days of Dressings*	Patients Cured	Per Cent Cured	Per Cent Non-cured
Excision and packing	24	6	90	19	79	21
Excision and partial closure	10	23	66	8	80	20
Excision and closure later open packing	2	0	94	1	50	50
Excision and primary closure	24	2	26	19	79	21
Excision and primary closure with drain	29	8	28	19	66	34
Averages	(89 cases)	7	50	(66 cases)	74	26

Total number treated by packing was 36 cases: 28 cures (78 per cent).
Total number treated by closed method was 53 cases: 38 cures (72 per cent).
* Average number of days after leaving hospital.

an open method. In every case an attempt was made to eradicate completely the diseased tissue, usually exposing the fascia over the sacrum and coccyx. In no case did the disease seem to involve the coccyx. Although cases have been reported in which the sinus extended to within the sacral canal,[33,62,72,106] none were found in this series. Spinal fluid was encountered only in the case occurring over the third dorsal vertebra, previously referred to.[48] Lesions extending down to and around the anus have occasionally been reported.[22,82,88,98,106] Although they rarely involve the anus, one case in this series had an associated anal fistula.

Postoperative treatment on protracted cases frequently included daily hot Sitz baths. Bakes were occasionally used. Smith[83] has suggested *x*-ray therapy and whom neither of these procedures was employed.

END RESULTS

The end results of curative surgery for pilonidal sinuses leave something to be desired. A prolonged healing time and recurrences, have been responsible for dissatisfaction with the results. In the present series replies to a questionnaire were received from eighty-nine patients who had undergone an excision of the lesion. The end results are shown in Table IX and are typical of those generally reported.[116] There was a "permanent cure" reported in 74 per cent of the cases, 72 per cent for the group treated by primary closure, and 78 per cent for the cases with open packing.

In Table IX the morbidity findings incidental to excision of the lesion are shown. The average period of incapacitation after leaving the hospital was seven days, six days for the patients treated by primary closure and ten days for open packed group. Only 18 per cent of the patients were incapacitated and the average period of further time away from work was five weeks. These cases represented 9 per cent of the "cured" group, as compared to 43 per cent of the "noncured;" the former averaged three days of further incapacitation and the latter twenty-five days.

All of the patients, excepting two who were treated by primary closure, required further dressings after leaving the hospital. The average healing time was fifty days, forty-five days for the cured cases as compared to seventy-two days for the noncured. The wounds of those treated by primary closure healed about three times as fast as those packed open: twenty-seven and eighty-four days, respectively.

A residual discomfort or pain at the site of operation was reported by 28 per cent of the patients who claimed a permanent cure following excision. Exactly two out of three in the "noncured" group experienced the same—an average of 36 per cent for the entire series. This discomfort and pain was twice as common in the patients treated by primary closure as in the open packed cases.

An analysis of the twenty-three noncured cases showed eighteen patients who stated they had a complete recurrence of the lesion, three who stated they had only mild symptoms, and one whose wound "never healed." The interval between time of operation and onset of further trouble averaged twenty months. A third of these patients experienced symptoms within a month and two-thirds within a year. In three cases the time interval was over five years. The symptoms were identical to those present preoperatively, namely, pain and discharge, discharge only, and pain only, in order of their frequency. Eleven of these patients were apparently ultimately cured, four with conservative treatment, one following incision and drainage, and five following a re-excision of the lesion. The remaining twelve patients were not symptom free at the time of the questionnaire, notwithstanding the fact that two of them had undergone a subsequent incision and drainage, and three had undergone one or more re-excision operations elsewhere.

Dunphy[23] has shown that the choice of suture material in pilonidal surgery is important. An analysis of the questionnaire cases with respect to this disclosed fifty-eight cases with known suture material, representing forty-two cures and sixteen noncures. The latter group can be augmented by nine patients who were re-operated upon in which the suture material was known at the time of their first operation. The totals then show nineteen failures in forty-two cases (45 per cent) in which catgut was used in the deep tissues, as compared to six failures in twenty-five cases (24 per cent) in which silk was used. These findings corroborate those of Dunphy, and the use of nonabsorbable suture material is advised.

Preoperative injection of methylene blue is recommended by some authors[117] and condemned by others.[12,73,80,105] The latter maintain that the operator frequently gets a false sense of security insofar as some channels are occluded and will not show the stain, that normal tissue may become stained, and that excision of this tissue will prove harmful because of the larger defect produced thereby. A study of the questionnaire cases with respect to the value of methylene blue injection showed that it was used in forty cases, ten patients of which were not cured (25 per cent). In the remaining forty-nine cases, in which no dye was used, there were thirteen noncures (29 per cent). To evaluate this problem further a group of thirteen patients re-operated upon can be added to the twenty-three noncures listed above. The results then show twenty-two failures in fifty-eight cases, (38 per cent) noncures in which no

dye was used, as compared to fourteen failures in forty-four cases, or 32 per cent noncures in which the dye was used. These data appear inconclusive but favor the school which recommends the preoperative injection of a dye to delineate the lesion.

SUMMARY AND CONCLUSIONS

1. The various theories on the origin of pilonidal sinuses are presented. The findings of a microscopic study of serial sections on forty human embryos are also presented. It definitely is a congenital anomaly, either of ectodermal or neural canal origin. The evidence is not conclusive in this respect.

2. The 350 cases studied represented an incidence of roughly 1:1,000. It is more common in males than in females and strikingly confined to the Caucasian race.

3. The defect usually manifests itself during the second and third decade of life. Females suffer earlier in life than males, a fact which apparently has etiological significance.

4. A positive hereditary factor is found suggesting an "anlage" for this defect in very early embryonic life.

5. Direct trauma plays a comparatively minor etiological rôle.

6. Pain and discharge are the predominating symptoms and are due to infection. Recurrent abscesses and one or more draining midline sinuses in the sacrococcygeal region are usually noted.

7. The pathological picture is that of a dermal sinus containing hair in about one-half of the cases. All of the sections showed evidence of either an acute or a chronic inflammation.

8. The diagnostic criteria are presented; diagnosis is usually simple.

9. Treatment remains an individualized problem. Incision and drainage is indicated in all cases of acute infection. Carnoy's solution following incision has merit in selected cases. Excision with primary closure is advisable in the comparatively uninfected and less extensive lesions. Excision and open packing is indicated in the more severe and recurrent lesions.

10. The end results of all methods of treatment leave something to be desired. A prolonged healing time and recurrence of the lesion are common problems.

11. The suture material used in the closure of wounds is important; silk is preferable to catgut.

12. Methylene blue used to delineate the lesion is recommended.

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REFERENCES

1. Anderson, A. W. Hair extracted from an ulcer. *Boston M. & S. J.*, 36: 74, 1847.
2. Anderson, J. K. Diagnosis and treatment of pilonidal sinus. *Minnesota Med.*, 14: 421–424, 1931.
3. Ballantyne, E. N. Sacrococcygeal tumors, adenocareinoma of cystic congenital embryonal remnant. *Arch. Path.*, 14: 1–9, 1932.
4. Bateman, E. J. Congenital tumors of the coccygeal region, *Ann. Surg.*, 80: 834, 1924.
5. Beck, E. G. Infected dermoid sacral cyst; excision; no suture; skin regeneration aided with adhesive strips. *Internat. Clin.*, 31: 32, 1921.
6. Biegeleisen, H. I. Sclerotherapy for pilonidal cyst. *Am. J. Surg.*, 44: 622–625, 1939.
7. Bland-Sutton, J. Dermoids. London, 1889. Bailliére, Tindall & Cox.
8. Block, L. H. and Greene, B. L. Pilonidal sinus; sclerosing method of treatment. *Arch. Surg.*, 37: 112–122, 1938.
9. Boldrey, E. B. and Elvidge, A. R. Dermoid cysts of the vertebral canal. *Ann. Surg.*, 110: 273, 1939.
10. Bookman, M. R. Treatment of sacro-coccygeal sinus (pilonidal sinus). *New York State J. Med.*, 24: 204, 1924.
11. Brams, J. Injection of pilonidal cyst with lipiodol. *Radiology*, 8: 248–249, 1927.
12. Breidenbach, L. and Wilson, H. L. Pilonidal cysts and sinuses. *Ann. Surg.*, 102: 455–463, 1935.
13. Cattell, R. B. Technic of operation for pilonidal sinus. *S. Clin. North America*, 14: 1289–1293, 1934.
14. Cattell, R. B. and Steller, L. W. The treatment of pilonidal sinus and end results. *New England J. Med.*, 206: 110, 1932.

15. Clark, S. N. Report of a case of spina bifida occulta in cervical region. *J. Nerv. & Ment. Dis.*, 48: 201–205, 1918.
16. Colp, R. Treatment of pilonidal cyst; and fistula. *Surg. Clin. N. America*, 9: 695–700, 1929.
17. Courad, J. Dépressions fistules congénitales cutanées, Thesis for Doctor of Medicine. Faculté de Médecine de Paris, Paris, p. 262, 1883.
18. Crookall, A. Preliminary report on the treatment of pilonidal sinus with silver nitrate. *Tr. Am. Proct. Soc.*, 28: 32, 1927.
19. Cupp, H. B. Pilonidal sinus. *M. Bull. Vet. Admin.*, 15: 291–293, 1939.
20. Cutler, E. C. and Zollinger, R. The use of sclerosing solutions in the treatment of cysts and fistulae. *Am. J. Surg.*, 19: 411, 1933.
21. Delafield, F. and Prudden, T. M. Text-book of Pathology. 16th ed., page 1209. Baltimore, 1936. Wm. Wood & Co.
22. Drueck, C. J. Post rectal tumors. *Am. J. Surg.*, 39: 247–249, 1925.
23. Dunphy, J. E. The operative treatment of pilonidal sinus. *Surgery*, 2: 581, 1937.
24. Eisberg, H. B. Pilonidal sinus. *Am. Med.*, 35: 152–154, 1929.
25. Fansler, W. A. and Anderson, J. K. Case of pilonidal sinus in a negro. *Minnesota Med.*, 17: 146, 1934.
26. Féré. *Bull de la Soc. Anat. de Paris*, 4 Série, 3: 309, 1878.
27. Ferguson, L. K. Pilonidal cysts. *Ann. Surg.*, 101: 469, 1935.
28. Ferguson, L. K. and Mccray, P. M., Jr. Pilonidal cysts; excision and primary suture in ambulatory patients. *Am. J. Surg.*, 36: 270, 1937.
29. Fox, S. L. The origin of pilonidal sinus. *Surg., Gynec. & Obst.*, 60: 137, 1935.
30. Gage, M. Pilonidal sinus. *Arch. Surg.*, 31: 175, 1935.
31. Gage, M. Pilonidal sinus. *New Orleans M. & S. J.*, 89: 13–17, 1936.
32. Gage, M. Pilonidal sinus. *Internat. Clin.*, 3: 19–32, 1936.
33. Gage, M. Pilonidal sinus, sacro-coccygeal ectodermal cysts and sinuses. *Tr. South. S. A.*, 50: 52–71, 1937.
34. Gage, M. Pilonidal sinus. *Ann. Surg.*, 109: 291, 1939.
35. Glenn, F. Review of 120 cases. *New England J. Med.*, 207: 544, 1932.
36. Goldberg, S. L. and Bloomenthal, E. D. Pilonidal sinuses in identical twins. *J. A. M. A.*, 113: 1401, 1939.
37. Goodsall, D. H. and Miles, W. E. Diseases of the Anus and Rectum. London, 1900. Longman's Green & Co.
38. Hamby, W. B. Pilonidal cysts, spina bifida occulta and bifid spinal cord. *Arch. Path.*, 21: 831–838, 1936.
39. Hayter, H. M. Pilonidal sinus. *Virginia M. Monthly*, 54: 447–449, 1927.
40. Hodges, R. M. Pilonidal sinus. *Boston M. & S. J.*, 103: 485, 1880.
41. Horsley, G. W. Pilonidal sinus. *Virginia M. Monthly*, 60: 104–107, 1933.
42. Johnson, W. J. and Livingston, A. G. Pilonidal sinus—incidence in mental defectives. *J. Nerv. & Ment. Dis.*, 87: 156–158, 1938.
43. Jones, H. W. Pilonidal sinus. *New York State J. Med.*, 27: 845, 1927.
44. Kallet, H. I. Pilonidal sinus—the factor of adolescence. *Tr. Am. Proct. Soc.*, 37: 163, 1936.
45. Kallet, H. I. Pilonidal sinus. *Am. J. Surg.*, 50: 648, 1940.
46. Keibal, F. and Mall, F. P. Human Embryology. Vol. 2, pp. 56–57. Philadelphia, 1912, J. B. Lippincott & Co.
47. Kleckner, M. S. Pilonidal sinus, its surgical management. *Tr. Am. Proc. Soc.*, 37: 166, 1936.
48. Kooistra, H. P. Pilonidal sinuses occurring over the higher spinal segments with report of a case involving the spinal cord. In publication.
49. Kuhn, F. A. Bulletin Soc. de chirurgie de Paris—Paris, 2 serie 7–8, p. 319, 1867.
50. Kuhn, F. A. *Bull. société de chir. de Paris*, 2: 334, 1867.
51. Kunitomo, K. The development and reduction of the tail and of the caudal end of the spinal cord. *Embryology*, 26: 167, 1918.
52. Lahey, F. H. An operation for pilonidal sinus. *Surg., Gynec. & Obst.*, 48: 109, 1929.
53. Lahey, F. H. A further suggestion for the operative treatment of pilonidal sinuses. *Surg., Gynec. & Obst.*, 54; 521–523, 1932.
54. Lamadrid, J. J. *Phila. Med. Times*, 3: 699, 1873.
55. Lannelongue. *Bull. et mém. Soc. de chir de Paris*, 8: 185, 1882.
56. LaRochelle, F. D. An operation for pilonidal sinus. *Clin. Med.*, 38: 244–246, 1931.
57. Lockhart-Mummery, J. P. *Brit. M. J.*, 7: 807, 1921.
58. Maillard, E. R. Nonsurgical treatment of a pilonidal cyst. *J. A. M. A.*, 43: 1383, 1929.
59. Mallory, F. B. Sacro-coccygeal dimples, sinuses, and cysts. *Am. J. M. Sc.*, 103: 263, 1892.
60. Masson, J. C. Sacro-coccygeal sinuses and cysts. *Surg. Clin. N. America*, 5: 737, 1925.
61. Mechling, C. C. Congenital proctologic defects in twins. *J. A. M. A.*, 102: 367, 1934.
62. Moise, T. S. Staphylococcus meningitis secondary to a congenital sacral sinus. *Surg., Gynec. & Obst.*, 42: 394–397, 1926.
63. Morter, C. W. Excision of pilonidal sinus—partial primary closure. *Tr. Am. Proct. Soc.*, 29: 13, 1928.
64. McKirdie, M. Pilonidal sinus. *Ann. Surg.*, 107: 389–399, 1938.
65. Newell, R. L. Coccygeal sinus. *Brit. J. Surg.*, 21: 219–228, 1933.
66. Oehlecker, F. Sacral abscesses by congenital skin displacements. *Deutsche Ztschr. f. Chir.*, 197: 262, 1926.
67. Ottenheimer, E. J. Some observations on the treatment of pilonidal sinus. *Am. J. Surg.*, 21: 120, 1933.
68. Ottonello, P. Contributo alla conoscenze della syndromi rare da tumori embriogenetici. *Riv. di pat. nerv.*, 41: 512–531, 1933.

69. OWEN, H. R. Pilonidal cyst or sinus with a report of 40 cases. *S. Clin. N. America*, 14: 117–126, 1934.
70. POUTHIOU, LAVIELLE, P. J. The sacrococcygeal infundibulum and congenital paracoccygeal fistulae. *Internat. Clin.*, 4: 77, 1923.
71. RANKIN, F. W. and DONALD, J. M. Dermoid cyst. *S. Clin. N. America*, 12: 913–915, 1932.
72. RIPLEY, W. and THOMPSON, D. C. Pilonidal sinuses as a route of infection in a case of staphyloccus meningitis. *Am. J. Dis. Child.*, 36: 785, 1928.
73. ROGERS, H. Pilonidal sinus. *Surg., Gynec. & Obst.*, 57: 803, 1933.
74. ROGERS, H. and DWIGHT, R. W. Pilonidal sinus—observations on one hundred forty cases treated by cautery excision. *Ann. Surg.*, 107: 400–418, 1938.
75. ROGERS, H. and HALL, M. G. Pilonidal sinus—Surgical treatment and pathologic structure. *Arch. Surg.*, 31: 742–766, 1935.
76. SALEEBY, E. and MCCARTHY, P. A. Pilonidal sinus in negro. *Ann. Surg.*, 105: 634–635, 1937.
77. SANDISON, J. C. and BROWN, J. B. Tumors of sacrococcygeal region. *J. M. A. Georgia*, 21: 268–273, 1932.
78. SHARPE, A. M. Pilonidal sinus. *Am. J. Roentgenol.*, 38: 308–307, 1937.
79. SHARPE, W. and N. Neurosurgery—Principles, Diagnosis, and Treatment. P. 762. Philadelphia and London, 1928. J. B. Lippincott & Co.
80. SILVERMAN, I. Pilonidal Sinus and its Treatment. *New York State J. Med.*, 39: 1598–1602, 1939.
81. SMILEY, K. E. Pilonidal sinus. *Am. J. Surg.*, 27: 298, 1935.
82. SMITH, N. D. Pilonidal sinus. *S. Clin. N. America*, 19: 1021–1032, 1939.
83. SMITH, R. M. Roentgen irradiation as adjunct to surgical treatment of pilonidal cyst. *Am. J. Roentgenol.*, 38: 308–311, 1937.
84. STALEY, J. C. Sacrococcygeal dermoids. *Minnesota Med.*, 4: 428–432, 1921.
85. STAMMERS, F. A. Spinal epidural suppuration with special reference to osteomyelitis of the vertebrae. *Brit. J. Surg.*, 26: 336, 1938.
86. STONE, H. B. Pilonidal sinus (coccygeal fistula). *Ann. Surg.*, 79: 410, 1924.
87. STONE, H. B. The origin of pilonidal sinus. *Ann. Surg.*, 94: 317, 1931.
88. STONER, A. P. Significance of sacrococcygeal dermoids in relation to rectal disease. *J. Iowa M. Soc.*, 12: 145, 1922.
89. STREETER. Quoted by Stone.
90. STROBOL, W. G. Pilonidal sinus. *Minnesota Med.*, 22: 292, 1937.
91. SWINTON, N. W. and HODGE, C. C. The treatment of pilonidal sinus. *S. Clin. N. America*, p. 699, 1939.
92. TAIT, LAWSON. *Tr. Cong. Adv. Eng. Sc.*, Dublin, 1877.
93. THOMASON, T. H. Cysts and sinuses of the sacrococcygeal region. *Ann. Surg.*, 99: 585, 1934.
94. TERTILLON, M. *Bull. et mém. Soc. d chirurgie no de Paris*, 8: 54, 1882.
95. TOURNEAUX, F. and HERRMANN, G. Sur la persistance de vestiges médullaires coccygiens pendant toute la période foctale chez l'homme et sur le role de ces vestiges dans la production des tumeurs sacro-coccygiennes cong'enitales. *J. de l'ana. et physiol.*, 23: 498–529, 1887.
96. VON BONNEWITZ, O. R. Post anal dimple: dermoid fistula. *Journal of the American Institute of Homeopathy*, 17: 1924, pp. 325–327.
97. WALKER, A. E. and BUCY, P. C. Congenital dermal sinuses: a source of spinal meningeal infection and subdural abscesses. *Brain*, 57: 401, 1934.
98. WARMAN, W. M. A case of fistula-in-ano with pilonidal sinus. *West Virginia M. J.*, 32: 80, 1936.
99. WARREN, J. C. *Phila. Med. Times*, 3: 747, 1873.
100. WARREN, J. M. Abscess, containing hair on the nates. *Am. J. M. Sc.*, 28: 113, 1854.
101. WEINSTEIN, M. Pilonidal sinus. *Ann. Surg.*, 97: 80, 1933.
102. WEEDER, S. D. Pilonidal cyst, its etiology and treatment. *Ann. Surg.*, 98: 385–393, 1933.
103. WENDELSTADT, H. Dissertation. Bonn, 1885. (Quoted by Stone.)
104. WHARTON, D. J. Pilonidal cyst. *U. S. Nav. M. Bull.*, 30: 350, 1932.
105. WHITE, A. H. Postanal so-called "pilonidal" sinus. *Proc. Roy. Soc. Med.*, 31: 982–984, 1938.
106. ZIEMAN, S. A. Pilonidal cysts. *Surg., Gynec. & Obst.*, 66: 231, 1938.
107. Loc. cit.[21,32,59,92,95,106]
108. Loc. cit.[2,7,10,24,26,29,43,57,87,88,89,103,104]
109. Loc. cit.[8,12,24,29,39,41,44,60,73,81,91]
110. Loc. cit.[8,12,14,28,41,47,69,73,81,90,91,104]
111. Loc. cit.[2,36,39,44,61,63,81,86]
112. Loc. cit.[19,35,37,43,63,90,91,96]
113. Loc. cit.[9,15,38,48,62,68,72,79,85,97]
114. Loc. cit.[13,15,23,27,41,53,90,91,93,104,105]
115. Loc. cit.[2,5,10,12,39,69,80,81,98,106]
116. Loc. cit.[8,28,67,69,73,80,90,91,98,104]
117. Loc. cit.[10,19,60,69,90]

MORTALITY AND MORBIDITY IN SURGERY OF THE THYROID*†

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SOME ten years ago I presented an analysis of 148 operations for goiter performed upon 144 patients. It is my purpose now to make certain observations on the surgical technic, the mortality and the morbidity and to appraise in the light of ten years' additional experience certain concepts in regard to disease of the thyroid gland and its surgical treatment.

Whatever may be the etiological factor or factors in hyperthyroidism, it is apparent that hyperthyroidism is not a single condition but may manifest itself in a variety of clinical pictures and with different pathological entities, as determined by histological examination of the glands removed. The indications for surgical intervention in disease of the thyroid depend upon the clinical manifestations of hyperthyroidism, pressure symptoms and malignancy.

It would seem that the surgical classificaiton set forth in the earlier paper is a practical one and we may speak of hyperthyroidism that occurs in (1) adolescent children, (2) in young individuals—so-called Graves' disease—and (3) the hyperthyroidism of adenoma. It would seem that in the hyperthyroidism of Graves' disease there is a perverted secretion of thyroxin and we have intoxication of the individual by some type of incompletely formed or organized thyroxin, with the major damage to the nervous system. Large doses of thyroid extract or thyroxin when given to an individual will produce the tachycardia, the tremor, the loss of weight, the muscular instability, etc., but will not produce exophthalmos. It is also an interesting fact that the thyroid gland in Graves' disease has less iodine content per unit of gland tissue than either the normal thyroid or the gland in nodular goiter. In Graves' disease the threshold for thyroxin retention in the gland is grossly disturbed; a similar defect does not occur in the toxic adenomatous goiter. Furthermore, the hyperthyroidism of adenoma represents an attack primarily upon the cardiovascular apparatus and this type of hyperthyroidism is seldom associated with eye symptoms.

Another interesting feature of the hyperthyroidism of Graves' disease is that it "ebbs and flows" with periods of remission with comparative well being in spite of a continuing plus metabolism. Uninterrupted thyroidism means eventual degeneration of heart, brain, liver and muscular tissue, and there is a not infrequent group of individuals surviving in society with permanent hyperthyroidism and exhibiting various types of chronic invalidism from organic degeneration.

In so-called "border line" cases time will make the diagnosis positive. If a patient is suspected of being a border line thyroid case, delay will not be dangerous for the patient; and if it is a border line thyroid disease, it will declare itself in no uncertain terms if left alone. Laboratory tests for iodine or blood cholesterol determinations have not proved of much value in these individuals.

The final arbiter of success in thyroid surgery will be based upon the mortality

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and morbidity following operation. A number of factors enter into the consideration of every thyroid patient: (1) the "heart age"—not necessarily the year age; (2) the chronicity of the hyperthyroidism; (3) the weight loss during the hyperthyroidism, and (4) the patient's response to preoperative treatment. In hyperthyroidism autodigestion of tissue takes place with the greatest injury to the liver parenchyma, dehydration is almost a constant finding and proper and adequate surgical management will adopt all measures to aid depleted liver function.

Most of the patients that come to the surgeon have been taking large doses of iodine over long periods of time. We are recovering fortunately from the iodine debauch of the last fifteen years in regard to its application to thyroid disease. Yet it is still surprising to find a great many patients who have had hyperthyroidism for years and who have been intermittently under iodine therapy. These constitute the most refractive type of thyroid disease and are always difficult to bring within operative control, for there seems to be a fixation of the thyroxin mechanism under repeated or prolonged iodization.

It was early apparent that ligation of the superior pole of the thyroid brings about improvement in about 65 per cent of the cases, whereas hemisection is followed by improvement in about 85 per cent. With increasing experience we have paid less and less obeisance to basal metabolic determinations. Personally, I am convinced that there are some individuals with hyperthyroidism that have an apparently normal metabolism as estimated by our present laboratory methods of determination. Furthermore, basal metabolism has no comparative value if and when performed by different laboratories. Habitual use of the same laboratory does tend to give a fair evaluation. We have had patients come with basal metabolic reports of +50, or +60, which without any change in therapy gave a +28 or +30 in our laboratory. It is not an uncommon experience that under rest in bed, without any medication whatsoever, a high metabolic rate can be substantially reduced and under continuous rest in bed may be brought almost to a normal rate.

If the present concept of thyroxin metabolism be correct, the basal metabolism tells only the velocity of thyroxin manufacture at the time the test is made. However, it is a confirmed observation that postoperative crises occur in patients with low blood iodine. Basal metabolism is the weakest of all criteria for determining when to operate. True, a high basal metabolism indicates a high degree of blood iodine but a low basal metabolism in a hyperthyroid patient means that the danger of surgical intervention is relatively greater. Under hyperthyroidism the patient loses iodine and calcium as exhibited in the weight loss and increased calcium elimination by the urine.

The value of serial basal metabolism tests as a gauge for estimating the ability to withstand surgical intervention is greatly overestimated. The clinical condition of the patient is a much more reliable indication for thyroid resection than is any arithmetical figure of basal metabolism. Of more striking importance as a guide to surgical intervention is the degree of improvement in the patient as exhibited under adequate preoperative treatment. After a hyperthyroid patient by rest in bed, has become relaxed, is eating well, and dehydration has been overcome, with the pulse regular and of less frequency, we permit the patient to get out of bed and to do a little walking. The pulse is taken one-half hour before they are allowed out of bed, taken one-half hour after light activity and at the termination of an hour out of bed. A variation in pulse rate under this light form of activity, of more than ten or fifteen beats, and a persistence of an increase in rate of ten to fifteen beats for a period longer than an hour after the return to bed is considered a contraindication for surgical intervention. However, if the patient recovers the same pulse

rate upon being returned to bed after being up one hour we deem that patient capable of sustaining a thyroid resection.

In the preoperative preparations of all hyperthyroid patients a uniform plan is carried out. Seriatim the procedures are: (1) initial basal metabolic test; (2) a survey of the nasorespiratory apparatus; (3) a competent cardiac and laryngoscopic examination; (4) a complete rest in bed but occasionally allowing toilet privileges; (5) an ice bag, enclosed in woolen container, over heart and thyroid region, alternate hours from 9 A.M. to 6 P.M.; (6) a high caloric diet, with protein at least twice a day; (7) forced fluids by mouth; (8) a daily infusion of 1,000 cc. of normal saline plus 5 per cent dextrose. If dehydration is manifest a second daily infusion of 1,000 cc. of distilled water plus five per cent dextrose is given; (9) sedation, usually in the form of the barbitrates, ½ to 1 gr. of luminal three times a day; (10) daily sodium iodid gr. 7, intravenously, irrespective as to whether the patient is taking iodine by mouth. This procedure vary markedly reduces the preoperative hospital days.

The oxygen content of nitrous oxide is 9 per cent, ethylene 15 per cent and cyclopropane 50, and as goiter patients have an anoxemia, cyclopropane should theoretically be the anesthetic of choice. Cyclopropane, however, induces ventricular fibrillation and its explosive qualities are an ever present danger.

The hyperthyroid patient has a damaged liver and since avertin must be metabolized by the liver we have not been convinced of the wisdom in its choice. It may inhibit an inadequate liver metabolism after operation. However, a greater danger is a preoperative tachycardia as the result of having an anxious, wide-awake patient, waiting in the anesthetizing room and hearing the noise and bustle of an operating room. A preoperative tachycardia will exhaust the cardiac reserve necessary for a successful operation. We employ a partial rectal anesthesia or sedation by the use of paraldehyd in starch water solution in the proportions of 1 cc. of paraldehyd for ten pounds of body weight. This amount is diminished in the thin and emaciated, as well as in the very obese. With the exception of operations for ablation of the thyroid in heart disease, ethylene is almost uniformly employed for inhalation anesthesia.

It is a rather interesting commentary in looking over the series how seldom digitalis or allied drugs were used before operation.

Postoperative hemorrhage is rarely fatal. When bleeding does occur it appears in two forms: (1) hemorrhage under the skin flap; this type is easily recognized and controlled. At its worst it produces only a subcutaneous hematoma. (2) Hemorrhage underneath the muscles of the neck. Here it is not the gross quantity of blood that is lost that is dangerous but the retention of the blood in the traumatized fossa of the thyroid. Hemorrhagic collections in this location very quickly produce tracheal pressure, pressure on the laryngeal nerve and rapidly produce strangulation. Postoperative stridor is a danger sign of the utmost importance and the patient literally shrieks for an opening of the wound to release laryngeal pressure.

In this entire series postoperative hemorrhage was present in only four cases and none required re-operation for hemorrhage. A subcutaneous hematoma occasionally developed which, treated palliatively, was without any grave apprehension upon the part of the surgeon. Occasionally, bleeding would occur from the extremities of the skin incision requiring an additional Michel clip. There is, however, a peculiar complication that may occur following the subtotal resection. It is obvious that the divided muscles, after being united, are rather grossly injured, become edematous, spastic, thickened and unyielding. If these muscles are approximated over the trachea and there ensues a small degree of bleeding from the bed of the removed thyroid gland, continuous and progressive tracheal

pressure is exerted, with a gradual loss in the quality of the voice, and with a marked dyspnea from a relatively small collection of blood placed in a very disadvantageous position. This has occurred about three times in the entire series. This postoperative syndrome makes its appearance shortly after operation and in from three to four hours becomes progressively worse. The surgeon is under the impression he is dealing with a postoperative hemorrhage and may reoperate upon the patient, with further trauma. In addition to blood, a collection of serum in either fossa of the thyroid, held under densely spastic muscles, will produce the same postoperative complication. The symptomatology is so clear that having once observed the condition it is readily recognized and the treatment for it is surprisingly simple without any additional risk to the patient. When a patient, who has had a normal voice and breathing sounds immediately after operation, begins to develop a stridor with dyspnea, the Michel clips or sutures should be removed and the skin flaps elevated and some sterile gauze inserted under the flaps. At the end of a couple of hours the skin flap is elevated and the sutures uniting the muscle are divided and sterile gauze lightly packed into the space that presents itself upon the retraction of the divided muscle ends. From this time on the patient will gradually become better as the fluid collection will seep to the surface. At the end of forty-eight hours practically all of the symptoms due to this particular type of complication will have subsided and the muscles and skin flaps may be resutured with but a slight increase in hospital residence. In this entire series tracheotomy was employed on only two occasions, both for Riedel's struma.

Intrathoracic goiter has certain distinctive and well defined features. It is the end result of an adenoma that has had its origin in the neck, and later descends into the thorax, always carrying with it a blood supply that has been derived from the cervical vessels. The transverse and anteroposterior diameter of some intrathoracic goiters is so great that they cannot be removed intact without enlarging the superior aperture of the chest. We have not found it necessary at any time to divide the manubrium or the sternum to eviscerate an intrathoracic goiter. We have not hesitated to puncture an intrathoracic goiter with the finger and permit the soft, pulpy material to be evacuated through the puncture wound. The immediate result appears to be like a gross hemorrhage but it is only the highly vascularized contents of an encapsulated adenoma; with the collapse of the goiter, the intrathoracic shell, so to speak, can be brought into the neck and resected by more or less accepted forms of technic. It is of great importance in dealing with an intrathoracic goiter that the superior pole be ligated and divided so that the goiter may be eviscerated from above down over the manubrium. This is always possible if the goiter is freed of any attachment at the superior pole. In this way the main and major portion of the blood supply of the adenoma, the inferior thyroid, is brought up with the tumor into the exposed field of the neck.

The most distressing and dangerous complications following thyroid surgery are those that arise from disturbance in the innervation of the intrinsic muscles of the larynx. The larynx subserves two functions: one the respiratory function and the other the voice function. It is the respiratory function that is so vital for a continuation of normal breathing. The recurrent laryngeal nerve has two different groups of conducting fibers: one set supplies the abductor muscles and concerns itself with the amount of air space for respiration; the other conducting fibers supply the adductor muscles which are concerned with the voluntary muscles of the larynx and function in voice production. "About three times as many fibres are concerned in the performance of the

adductor function of the larynx as in the abductor function."

Some doubt has been cast upon the assumption that the superior laryngeal nerve is entirely a sensory nerve. It would seem that this nerve exercises some motor function concerned with voice as exhibited by the hoarseness that follows the continued use of the voice after some thyroid resections. It is an impression of mine that about 10 per cent of the patients with thyroid disease have some preoperative disability of the vocal cords not necessarily exhibited clinically by voice changes. The size and type of goiter apparently are not determinant factors as the impaired cord may not be on the same side as the largest tumor. Contralateral pressure, deviation of the trachea or stretching of the nerves may be the factor at fault. Furthermore, I believe that about 10 per cent of all cases submitted to bilateral thyroid resection have some temporary postoperative vocal cord disability. The majority of these eventually recover. Laryngoscopic examination during operation, or immediately thereafter, would tend to give a higher incidence of voice changes than that which eventually occurs.

It is an interesting fact that in complete ablation of the thyroid in which every effort is made to take out the entire gland there has been less voice disabilities than in the typical standard resections. I do not believe that the laryngeal nerves are cut or divided during the course of the modern operation, but I am quite convinced that subsequent cicatrization or secondary degeneration following trauma incurred at the time of the operation does produce a late postoperative paresis of one and rarely but unfortunately of both cords.

I have had a personal experience in private practice with two cases of bilateral paralyses of the vocal cords. The first occurred fourteen weeks after a bilateral resection for Graves' disease and the second followed an extensive operation for a huge intrathoracic goiter.

There are today two schools of thought regarding the laryngeal nerves in thyroid surgery: one, that in every case the recurrent laryngeal nerves should be exposed, dissected clear and followed to their final termination so that each nerve in turn is visualized during the entire operation. The other school holds to the belief that the less the surgeon sees of the laryngeal nerve the better. It has seemed to me that if artery clamps are always applied to thyroid tissue, well above the level of the branches of the inferior thyroid vessels and the resection is carried out from the midline outward entirely above the posterior capsule, anatomical severance or injury to the nerve does not occur.

The disabilities of voice changes in thyroid surgery are not without hope as time does bring about a remarkable compensation or even alleviation of the symptoms. I have in mind a gentleman who had bilateral disability and under electrical stimulation and time has gained a fair volume of voice and no breathing disability.

Of increasing importance is malignancy of the thyroid. Cancer occurs approximately in 3 per cent of all individuals having thyroid surgery. There are two types of malignancy that arise in the thyroid gland: one has its origin in adenomas and as long as it is encapsulated the prognosis is not hopeless. Carcinomas that arise from bronchial remnants and develop both in front and behind the carotid vessels have a much more dubious prognosis. Carcinomas from adenomas are radiosensitive, and even when incompletely removed an added number of years of life may be reasonably expected when surgery is followed by *x*-ray therapy.

It is a surprising thing how rare tetany is demonstrable in thyroid surgery. In a more than cursory review with this point in mind I have had in my own practice only one undoubted case of tetany. This patient had as wide a thyroid resection as possible for malignancy and was subsequently treated with *x*-ray. About three months after the operation she began to have typical tetanic convulsions which

were treated by Collips parathyroid hormone, plus calcium by mouth. In the first year the treatment was adequate because the patient usually had plenty of warning and was able to have her physician give her the required hypodermic injection. At the end of about three years she required no further injections of Collips serum but did complain of mild, transient attacks of laryngeal spasm with dyspnea. Upon giving the patient prostigmine hydrobromide by mouth these symptoms completely disappeared and at the end of about three months of such medication the patient was completely well and in the last year has had no trouble nor required any medication.

Table 1

A study of the mortality from July, 1923 to 1939, based upon the pathological examination

	No. Patients Operated	Mortality Deaths
Graves' disease (incidence)	287 (44%)	12 (4.2%)
Toxic adenomas (incidence)	103 (16%)	3 (3%)
Nontoxic adenomas (nodular, colloid and cystic) (incidence)	237 (36%)	0
Thyroiditis-Riedel's struma	10 (1.5%)	0
Carcinomas (1 sarcoma) (incidence)	15 (2.3%)	3 (20%)
Total series	652	18 (2.7%)

It is also curious that in the widest possible removal of the thyroid—ablation of the thyroid for heart disease—there has been no tetany or tetanic symptoms. It is true that every effort is made to preserve the parathyroids by careful dissection yet when one contemplates the difficulty of identifying the parathyroids and the resulting cicatrization that occurs in the thyroid fossa, it is surprising that we do not see tetany after this type of operation.

An analysis of a series of operations for thyroid disease will reveal certain trends and changes incident to improvement both in the technical procedures and in the experience of the operator. Mortality percentage, important though it be, is not the only criterion of success. What was the final result in those that survived? How complete was the relief? What morbidity ensued and how many patients were incompletely relieved? These questions are all pertinent to the inquiry.

Graves' disease contributed 44 per cent of the material;* toxic adenomas 16 per cent; nontoxic adenomas 36 per cent: thyroiditis, including Riedel's struma, 1.5 per cent, and malignancy 2.3 per cent. (Table 1.) There were 662 operations performed on 626 patients, as follows:

Bilateral subtotal resection	456
Unilateral subtotal resection or lobectomy	126
Local resection	57
Complete resection (ablation)	13
Polar ligation	6
Incision and drainage (for abscess or cellulitis)	4
Total operative procedures	662

From July, 1923 to January 1, 1939, there were 287 patients operated upon for Graves' disease. The average age of the patients was thirty-four years, composed of fifty-six males and 231 females. The average duration of symptoms was 1.5 years, and 226 or approximately 80 per cent had demonstrable eye signs. The average basal metabolic rate was 46 per cent and there were twelve deaths, or 4.2 per cent mortality. (Table II.) An interesting fact emerges if we survey the effect of establishing a goiter clinic. From July, 1923 to 1929, there were seventy-three patients with Graves' disease, with an average duration of symptoms of 2.6 years and a mortality of 8 per cent. From 1929 to 1934 there were 106 patients with symptoms of 1.1 years duration and a mortality of 5.6 per cent. From 1934 to 1939 there were 108 patients with symptoms of one years' duration and no mortality, and in the last 163 operations for Graves' disease there has been no death.

* Diagnosis based upon pathological examination of tissue removed up to December, 1938.

The contrast between Graves' disease and toxic adenomas is marked in many details. Toxic adenomas comprised 16 per cent of the operative material. The average age of this group was forty-four years, as against thirty-four years for the Graves' disease group, and less than 5 per cent had eye signs. Furthermore, the years, 1934 to 1939, in forty-six patients there were three deaths or 6.5 per cent. For the total number of 103 patients the total death rate was 2.9 per cent.

When we analyze nontoxic adenomatous goiter we find that the average age of the patients at the time of surgical intervention —thirty-nine years—lies exactly half way

TABLE II

A STUDY OF GRAVES' DISEASE IN A FIVE-YEAR PERIOD

Operative Period	No. of Cases	Aver. Age, Yrs.	Sex		Aver. Duration Symptoms, Yrs.	Eye Signs	Average B.M.R.	Deaths
			M.	F.				
July 1923 to 1929	73	31	11	62	2.6	63	53+	6 (8%)
1929 to 1934	106	35	19	87	1.1	73	49+	6 (5.6%)
1934 to 1939	108	34	26	82	1	90	39+	0
Total for series	287	34	56	231	1.5	226	46+	12 (4.2%)

TABLE III

A STUDY OF TOXIC ADENOMAS OF THE THYROID IN A FIVE-YEAR PERIOD

Operative Period	No. of Cases	Aver. Age, Yrs.	Sex		Aver. Duration Symptoms, Yrs.	Eye Signs	Average B.M.R.	Deaths
			M.	F.				
July 1923 to 1929	8	42	0	8	12	0	34+	0
1929 to 1934	49	44	1	48	1.7	3	32+	0
1934 to 1939	46	44	6	40	1.3	2	29 + 6	3
Total for series	103	44	7	96	2.3	5	31+	3 (2.9%)

average basal metabolism was 31 for toxic adenomas as contrasted with +46 in the Graves' disease group. (Table III.)

In regard to mortality rate a paradoxical situation arises in our series in that there were less deaths following surgery for toxic adenomas than for Graves' disease. The occurrence of deaths in a series is rather a matter of the "run of affairs." For example, from 1923 to 1934 in fifty-seven patients operated upon for toxic adenomatous goiter there were no deaths, yet in the next four

between the age group of Graves' disease thirty-four years—and toxic adenoma—forty-four years. It is reasonable to assume that many of the nontoxic adenomas would change to toxic adenomas within the succeeding five years. The average basal metabolic rate for nontoxic adenoma was +6. There were in all 237 patients operated upon, with no mortality. (Table IV.) In 287 operations for Graves' disease there were thirty-one complications, as follows: wound infections, seven; severe postopera-

tive thyrotoxicosis (crises) six; cardiac decompensation, four; postoperative hemorrhage, three; bronchitis, three; postoperative psychosis, two; atelectasis, two; vocal cord paralysis, unilateral, two; carbuncle of buttocks, one; severe cystitis, one. In 103 operations for toxic adenomas, there were fourteen complications, as follows: cardiac decompensation, seven; postoperative thyrotoxicosis, three; wound infection, two; diabetes, one; otitis media, one. In 237 operations for nontoxic adenomas, there were fourteen complications, as follows: cardiac compensation, five; bronchitis, three; tracheal compression, one; cerebral embolism (mild) one; otitis media, one; postoperative hemorrhage, one; wound infection, one. In twenty-five operations for carcinoma and Riedel's struma there were four complications as follows: tracheal collapse, two; cellulitis on neck, one; crisis, one.

TABLE IV

A STUDY OF NONTOXIC ADENOMAS AND NODULAR GOITER IN A FIVE-YEAR PERIOD

Operative Period	No. of Cases	Aver. Age, Yrs.	Sex		Aver. Duration Symptoms, Yrs.	Eye Signs	Average B.M.R.	Deaths
			M.	F.				
July 1923 to 1929	16	31	3	13	10	3	17+	0
1929 to 1934	110	37	11	99	3.2	6	7+	0
1934 to 1939	111	32	20	91	3.1	2	4+	0
Total for series	237	39	34	203	3.6	11	6+	0

TABLE V

A STUDY OF RIEDEL'S STRUMA AND CARCINOMAS OF THE THYROID FROM JULY, 1923 TO 1939

Pathology	No. of Cases	Aver. Age, Yrs.	Sex		Aver. Duration Symptoms, Yrs.	Average B.M.R.	Deaths
			M.	F.			
Riedel's struma (thyroiditis)	10	38	2	8	2	(114+ to 20−)	0
Carcinoma (1 osteosarcoma)	15	48	1	14	2.1	.....	3

It has been found that the rapidity of pulse rate during the course of operation can be very markedly influenced by the hypodermic injection of ergotamine tartrate (gynergen). Dr. Milton C. Peterson, Chief of the Department of Anesthesia at the Post-Graduate Hospital, states that early in the course of a resection of the thyroid he has given a subcutaneous injection of .25 mg. of ergotamine tartrate. Later, at the beginning of the resection of the second lobe, he has given a second dose of .25 mg. in the intravenous normal saline solution. The pulse dropped from 180 to the neighborhood of 100, the blood pressure was sustained and the effect was very prolonged. This is a procedure that is well worth considering in the grave thyroid risks.

It is to be anticipated that nodular goiter will have a tendency for reformation of new adenomas. Such a condition is in no way comparable with the recurrence of hyperthyroidism in Graves' disease. The degree of hyperthyroidism is not proportional to the size or weight of the thyroid that is left after subtotal resection. A very small quantity of active thyroid

tissue left *in situ* may mean the prolongation of hyperthyroidism, or after a period of apparently normal thyroid secretion, may have a secretory reactivation and without enlargement or hypertrophy reinitiate the signs and symptoms of hyperthyroidism so that a portion of thyroid on one or other side of the neck, 2 cm. by 1 cm., has been in some of our cases a cause for reactivation or recurrent hyperthyroidism. It is basically true that the permanence of relief from hyperthyroidism and the prevention of recurrence of symptoms rest primarily on the completeness of the resection.

TABLE VI
CLASSIFICATION AND OPERATIVE MORTALITY OF GOITER PATIENTS FROM JULY, 1923 TO DECEMBER 31, 1940

	No. of Patients Operated	Deaths	Mortality Per Cent
Graves' disease (incidence)	315	12	3.8
Toxic adenomas (incidence)	128	3	2.4
Nontoxic adenomas (incidence)	258	0	
Thyroiditis and Riedel's Struma (incidence)	10	0	
Total	711	15	2.1
Malignancy	16	3	18.7
Total	727	18	
Mortality including malignancy	...	..	2.6

To the previous series seventy-five cases have been added for 1939 and 1940.

In our own series approximately 3 per cent of the cases of Graves' disease had a recurrence of hyperthyroidism and approximately 3 per cent came to us from other clinics, making an overall of recurrent hyperthyroidisms of 6 per cent in the cases of Graves' disease.

I, personally, am convinced that chronic infection of the nose and throat may produce symptoms such as tachycardia and nervousness in a patient who has been sensitized by chronic hyperthyroidism, symptoms closely corresponding to the typical symptomatology of hyperthyroidism. It is our policy to try to prevent the continuation of any nose and throat infection or for that matter any chronic infection in a patient who has been submitted to thyroid surgery.

Approximately 50 per cent of the cases of toxic adenomas have cardiac symptoms and at least half of these have definite organic heart disease. The degree of heart impairment is directly proportional to the chronicity of the hyperthyroidism and some of the most brilliant result in thyroid surgery are obtained in the patients with thyrotoxic heart conditions from toxic adenomas. The operative risk in this group of patients is great; but if a patient with a thyrotoxic heart is able to be on his feet and walk about, he is usually able to survive a thyroid resection after adequate preoperative treatment and rest in bed.

Dividing the operation for thyroid disease into two stages has not been necessary in many patients. In analyzing the causes of death a case might possibly be made out for some of the patients for the two-stage procedure. In only about 5 per cent of all the patients operated upon was a two-stage procedure employed and the two-stage principle has been utilized equally between patients with Graves' disease and patients with toxic adenomas.

CONCLUSIONS

In conclusion it seems that certain concepts result from our analysis: overdosage and continuous administration of iodine preparations are to be discouraged. Iodine does not cure goiter. At best it is of aid in preoperative treatment and the control of symptoms and of great value in crises. Postoperative crises are becoming less and less frequent and have occasioned very little apprehension upon our part in the last few years.

The percentage of cancer of the thyroid is fairly constant and it may be possible

to prevent malignancy by considering every patient with nodular goiter an operative case.

Brilliant results are obtained in the cardiac disabilities from toxic adenomas. In Graves' disease surgery is one phase of the therapy. The patients must be placed under proper medical regimen and controlled for not less than a year after the operation. Basal metabolic determinations are but one sign of hyperthyroidism and overemphasis upon them is to be deprecated. Finally, voice and respiratory difficulties after thyroid surgery are still a pressing problem in the hands even of the expert thyroid surgeon.

The serious nervous manifestations (in toxic nodular goiter) are most commonly observed in patients who have had evidence of toxicity with remissions over a period of many years, signifying that there was degeneration in the thyroid gland before the manifestations of toxicity and mental aberration began.

From—"Diseases of the Thyroid Gland. Presenting the Experience of More Than Forty Years"—by Arthur E. Hertzler (Paul B. Hoeber, Inc.).

OPERATIVE TECHNIC FOR DIVISION OF RENAL ISTHMUS IN HORSESHOE KIDNEY*

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OPERATIONS for the relief of associated pathologic conditions in the horseshoe kidney have been performed since the opening of this century. Albarran, Israel, Martinow, Kidd, Judd and other surgeons operated upon fused kidneys of this type that were found accidentally at operation. But the condition of horseshoe kidney disease was not recognized as an entity until urography was introduced. Since that time, urographic studies have made it possible to diagnose this condition before operation with an accuracy of almost 100 per cent. However, conservative operations for the reconstruction of the anomalous organ did not come into use until rather recently, when Papin, Foley and others began to employ these operations for the relief of symptomatic pain and lack of drainage.

TABLE 1

SURGICAL TREATMENT OF HORSESHOE KIDNEY. FOUR GROUPS OF CASES

Group I. Horseshoe kidney not found until postmortem examination, which during life had appeared to be normal and which clinically had presented no urologic symptoms calling for surgical treatment.

Group II. Horseshoe kidney associated with urologic conditions consisting of: (1) Urinary symptoms, (2) indefinite abdominal pain, (3) gastrointestinal disturbances (most frequently marked constipation), this *triad* constituting the *horsesboe kidney syndrome*, for the relief of which division of the renal isthmus is indicated. The majority of clinical cases fall in this group.

Group III. Horseshoe kidney with some gross type of associated pathology in one-half of the fused organ, as in calculous pyonephrosis, functionless hydronephrosis, tumor or tuberculosis, in all of which, when unilateral, heminephrectomy is indicated.

Group IV. Horseshoe kidney with gross associated pathology in both renal pelves, as in bilateral nephrolithiasis or hydronephrosis, in which some type of conservative surgical procedure is indicated in accordance with the functional capacity of each kidney.

My purpose at this time is to draw attention to the clinical indications for division of the renal isthmus when the diagnosis of horseshoe kidney has been made urographically, and to describe the surgical technic of the operation, with a report of an illustrative case in which I have operated recently for the relief of horseshoe kidney disease, with excellent results.

In Table 1, I have tabulated four groups of cases of horseshoe kidney based upon the type of surgery indicated. These four groups embrace: (1) Cases without symptoms of any kind, discovered accidentally or at autopsy, which clinically had called for no surgical treatment; (2) cases associated with urologic conditions, consisting of urinary symptoms of various kinds, with indefinite abdominal or lumbar pain, and with reflex gastrointestinal disturbances, all more or less chronic or appearing in acute recurrent attacks. These are the cases for which division of the renal isthmus is indicated to restore normal anatomic relations, relieving pressure upon important vessels and nerves and restoring proper renal drainage. They constitute the great majority of clinical cases. (3) Cases presenting some type of gross associated pathology in one-half of the fused organ, for which heminephrectomy is indicated, and (4) cases with gross pathological conditions in both halves of the fused organ, calling for some type of conservative operation based on the degree of functional capacity of each kidney. (Table 1.)

The cases in Group II are those in which I am especially interested, since these are the cases that can be restored to normal

* Read before the Section of Genito-Urinary Surgery, New York Academy of Medicine, April 16, 1941.

function and complete health by simple division of the renal isthmus, followed by a nephropexy of one or occasionally both sides. These cases are the ones most commonly observed clinically, and they constitute what I have elsewhere described as horseshoe kidney disease.

In order to clarify the matter, I have drawn up Table II, in which are shown the principal *indications* for division of the isthmus when the diagnosis of horseshoe kidney has been made. This Table comprises the three major forms of symptoms constituting the triad of the horseshoe kidney syndrome, or as I prefer to call it, the horseshoe kidney disease, which are then graphically subdivided into their details in Tables II-A, II-B and II-C, for more practical use. These tables show: (1) the most common *urinary symptoms* observed, (2) the most frequent types and sites of *indefinite lumbar and abdominal pain*, and (3) the principal *reflex symptoms* and conditions met with, especially in the *gastrointestinal tract*. This triad or complex of symptoms lies at the bottom of horseshoe kidney disease. (Tables II, II-A, II-B and II-C.)

TABLE II

PRINCIPAL INDICATIONS FOR DIVISION OF RENAL ISTHMUS WHEN THE DIAGNOSIS OF HORSESHOE KIDNEY HAS BEEN MADE

Horseshoe kidney disease (horseshoe kidney syndrome)

A. Urological symptoms of various types
B. Indefinite renal or abdominal pain
C. Reflex symptoms manifested in gastrointestinal disorders

TABLE II-A

PRINCIPAL INDICATIONS FOR DIVISION OF RENAL ISTHMUS WHEN THE DIAGNOSIS OF HORSESHOE KIDNEY HAS BEEN MADE

Horseshoe kidney disease (horseshoe kidney syndrome) — A. Urological symptoms and conditions most frequently observed

1. Pyelectasis and caliectasis with evidence of pyelitis and pyelonephritis
2. Moderate degree of hydronephrosis
3. Inwardly rotated renal pelves and calyces that cannot drain, giving evidence of urinary stasis and infection
4. Anterior position of the ureters, situated in front of the renal isthmus, interfering with the dynamism and affecting the emptying time of the renal pelves
5. Repeated crises of urinary disturbances such as infection with dysuria, frequency, hematuria, pyuria, albuminuria and attacks of renal pain and chronic nephritis
6. An intravenous urogram or phthalein test showing that both kidneys still have adequate function to warrant the operation

TABLE II-B

PRINCIPAL INDICATIONS FOR DIVISION OF RENAL ISTHMUS WHEN THE DIAGNOSIS OF HORSESHOE-KIDNEY HAS BEEN MADE

Horseshoe kidney disease (horseshoe kidney syndrome) — B. Types of indefinite renal or abdominal pain most frequently observed

1. Pain that has been definitely excluded from other abdominal conditions
2. Pain in epigastric region
3. Pain in umbilical region
4. Pain in right lumbar region
5. Pain in left lumbar region
6. Pain across the back
7. Pain in right or left lower quadrant
8. Pain more marked on bending of the abdomen or stretching of back
9. Pain more obvious upon pressing the renal isthmus at the midline
10. Pain either acute, mild or intermittent according to the degree of inflammation, compression, fixation and position of the anomalous kidney, or according to the degree of pyelitic stasis or any other type of associated pathology that may be present in the horseshoe kidney

TABLE II-C

PRINCIPAL INDICATIONS FOR DIVISION OF RENAL ISTHMUS WHEN THE DIAGNOSIS OF HORSESHOE KIDNEY HAS BEEN MADE

Horseshoe kidney disease (horseshoe kidney syndrome) — C. Reflex symptoms and conditions most frequently observed

1. Disturbances of the gastrointestinal system with the gastroenterorenal syndrome
2. History of chronic constipation
3. History of colitis and diarrhea
4. Reflex pain of indefinite abdominal location
5. Absence of evidence of any other type of gross associated pathological condition in the kidney, which may demand a heminephrectomy
6. Conditions calling for conservative operation on the horseshoe kidney (such as stone or hydronephrosis), in which division of the renal isthmus should always be done to relieve pain and restore renal function

ILLUSTRATIVE CASE OF HORSESHOE KIDNEY DISEASE WITH OPERATION FOR DIVISION OF RENAL ISTHMUS AND RIGHT NEPHROPEXY

The urographic examination disclosed the presence of horseshoe kidney with evidence of pyelitis, pyelonephritis and urinary stasis. This condition was relieved by a right kidney

operation consisting of division of the isthmus of the horseshoe kidney, followed by right nephropexy.

Fig. 1. Plain roentgenogram with catheters and cystoscope in position, showing the abnormal position of the right ureteral catheter close to the spinal column and the left ureteral catheter rotated inward, suggesting a fused kidney. Moreover, the shadow of the lower pole of each kidney appears to be running into the midline, suggesting that the fused organ is a horseshoe kidney.

Fig. 2. Bilateral retrograde pyeloureterogram, revealing the presence of a horseshoe kidney. Note the inward rotation of the calyces, the high implantation of the ureters and the lack of drainage which has caused pyelectasis, calyectasis and the *horseshoe kidney syndrome.*

H. M., a woman forty-two years of age, was referred to me for surgical treatment, with a roentgenographic diagnosis of horseshoe kidney, and was admitted to the Murray Hill Hospital on April 4, 1939. She had been suffering with persistent indefinite abdominal pain of many years' duration, which had at times been very acute. Ten years previous to observation appendectomy was carried out without relief. Early in 1939 she had had another attack of abdominal pain, which was then believed to be due to the gallbladder; but *x*-ray examination of the gastrointestinal tract and gallbladder studies were negative. The patient also had a history of chronic constipation with pain in the epigastric, umbilical and right lumbar regions, frequency of urination day and night, dysuria, urgency, microscopic pyuria and hematuria. These symptoms had been accompanied by intermittent abdominal pain with gastrointestinal disorders and pain across the back off and on for more than twenty years.

Her chief complaints at time of admission were (1) persistent abdominal pain in the epigastrium and about the umbilical region, radiating to the right lumbar region, (2) gastrointestinal disorders and chronic constipation, (3) frequency of urination, dysuria, urgency, albuminuria, microscopic pyuria and hematuria.

The patient was married but had no children. There was no history of pregnancy although she had menstruated since the age of fourteen. Otherwise the gynecological examination was negative. She had always been weak, nervous and anemic. There was a history of chronic constipation from birth, pain across the back off and on which was more severe while standing or bending; gastrointestinal disturbances, abdominal distention and sometimes diarrhea. Appendectomy was done ten years before in an effort to relieve the indefinite abdominal pain in the upper right quadrant as well as nausea, vomiting and rigidity of abdomen.

Physical examination revealed the abdomen to be rigid and contracted, but on percussion one detected the presence of gas. No bowel movement had occurred for four days. Both right and left kidneys were low in position and palpable; the right one was somewhat tender on pressure. After a proper cathartic and daily high colonic irrigations, which allowed the abdomen to become soft, the isthmus of the horseshoe kidney was rather tender and defi-

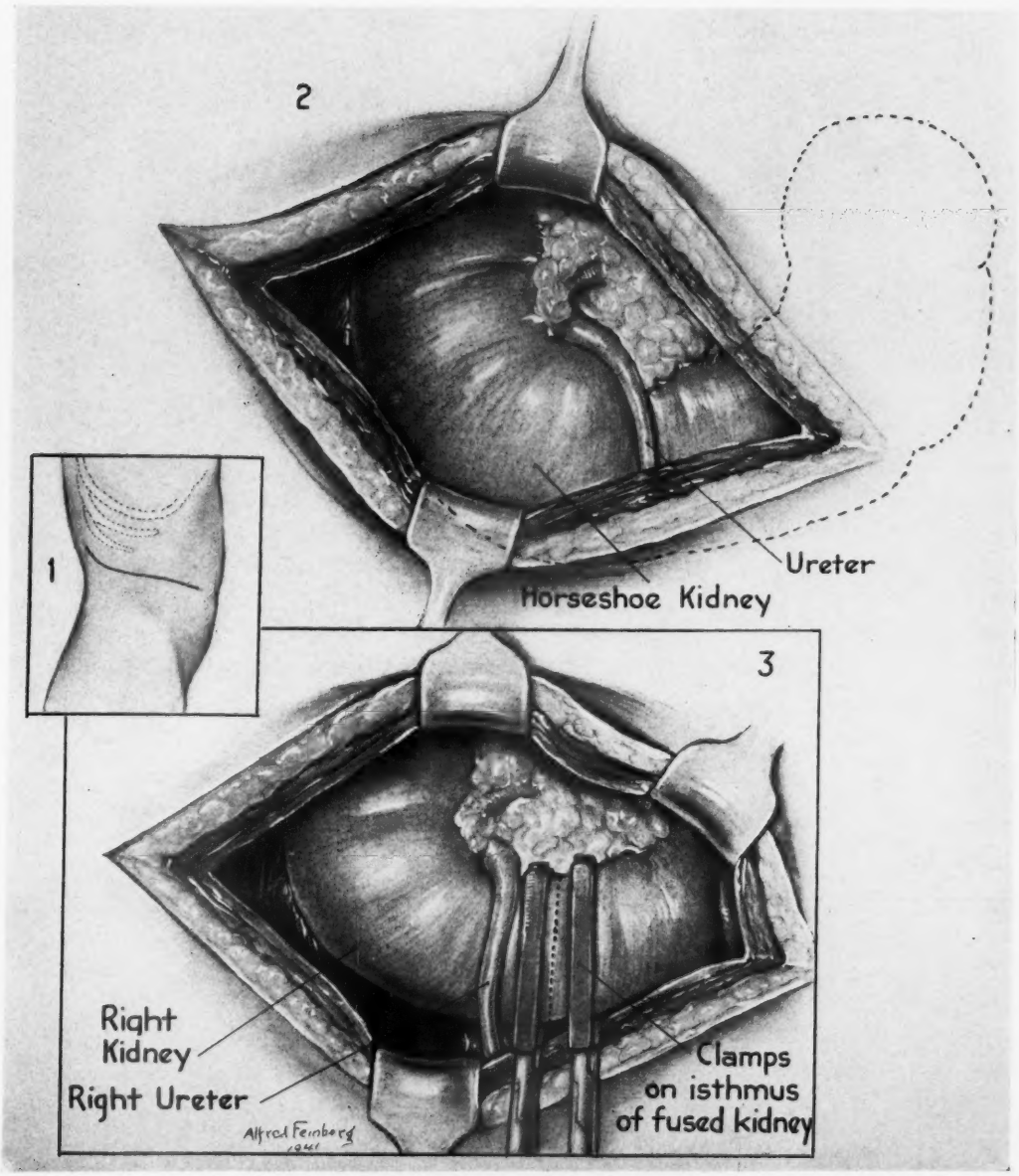

FIG. 3. Operative technic for division of renal isthmus in horseshoe kidney. (1) Drawing of the lumbo-abdominal transverse incision to expose the isthmus of the fused kidney; (2) anatomical exposure of the horseshoe kidney showing the anterior position of the right ureter lying upon the isthmus; (3) the renal isthmus has been mobilized, thoroughly exposed and doubly clamped. The dotted line indicates the line of division of the isthmus between the clamps.

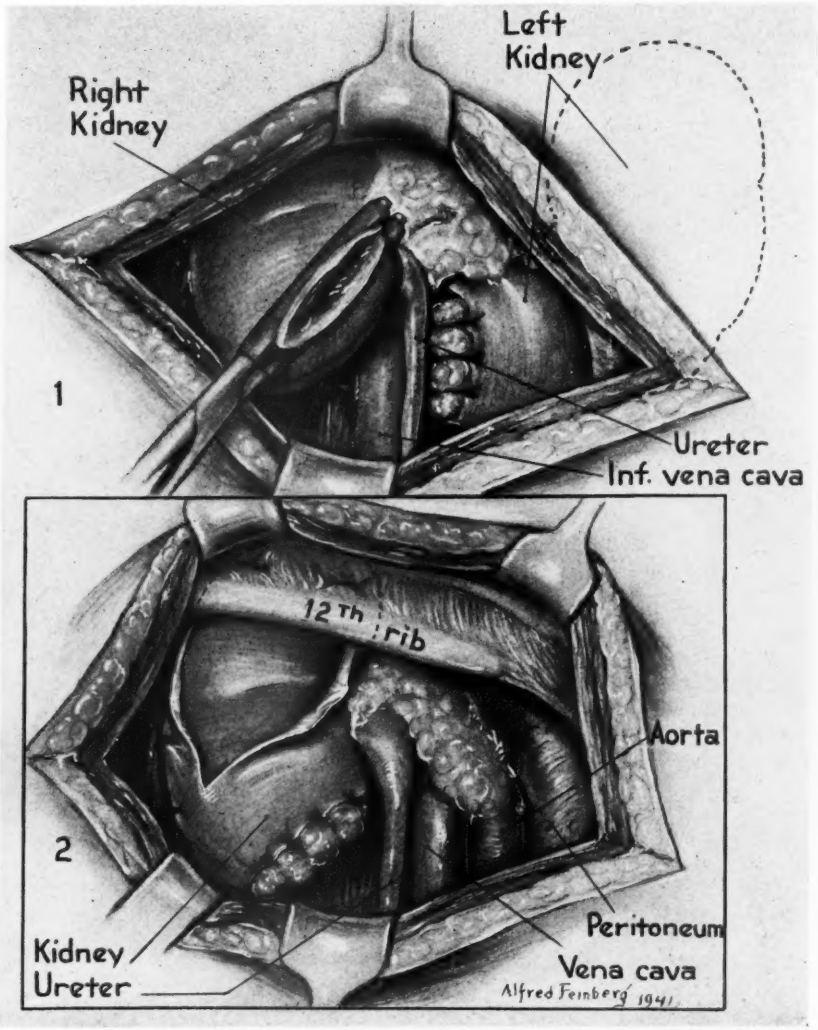

FIG. 4. Operative technic for division of renal isthmus in horseshoe kidney. Final steps in the surgical procedure: (1) The stump of the left portion of the divided isthmus has been sutured over interposed fat to prevent bleeding. This stump of the left kidney is then pushed across the midline under the peritoneum in order to allow it to rotate and occupy its normal position in the left lumbar region. The drawing also shows the rubber clamp holding the right stump of the isthmus in position where it prevents bleeding and facilitates the technical procedures. (2) Surgical exposure of the right kidney and right ureter, revealing the close anatomic relationship to the aorta and vena cava, after the left kidney has been rotated from its position in the midline. The stump of the isthmus of the right kidney has been similarly covered with fatty tissue and sutured by interrupted sutures to prevent hemorrhage and also possible leakage of urine from a sectioned lower calyx. The upper pole of the right kidney has been decapsulated and anchored by nephropexy. The lower pole also has been fixed laterally and posteriorly to the lumbospinal muscles by two separated sutures in order to make the kidney rotate outward and to prevent its contact with the right ureter, thus securing good drainage. The wound is now ready for closure as in an ordinary nephropexy.

nitely palpable in the midline. The urine was hazy and contained pus and blood. Cultures were positive for Bacillus coli; blood pressure was 160/100. The patient on admission had a temperature of 100°F. and was quite toxic. The proper urinary antiseptics were ordered, also forced fluids, daily high colonic irrigation and preliminary preparation for urologic and urographic examination the following day.

Fig. 5. Plain roentgenogram with ureteral catheters in position taken three weeks after operation for relief of horseshoe kidney disease. Note that the two catheters are now widely separated from the spinal column and give the impression that both kidneys have rotated and occupy their normal positions in their respective lumbar regions.

Fig. 6. Right retrograde pyeloureterogram taken three weeks after division of the isthmus and right nephropexy, indicating the restoration of normal function and virtually normal anatomical relationship of the excretory apparatus of the organ, which has relieved the horseshoe kidney syndrome.

Cystoscopy, catheterization of the ureters and retrograde bilateral pyelograms disclosed that both kidneys had fairly good function regarding urea and phthalein elimination. A plain film with catheters and instrument in position showed the area of the right kidney to be low and indefinitely outlined. The lower pole appeared to run into the midline about the level of the third lumbar vertebra. The left kidney shadow was also fairly well delineated. The lower pole also appeared extended toward the midline, suggesting a fused kidney placed quite low in position. There was no shadow indicative of stone anywhere in the urinary tract. (Fig. 1.)

The right kidney pelvis was unusual in shape and of real interest. It was rotated inward with the calyces pointing toward the spinal column, giving the impression of horseshoe kidney. The major and minor calyces were dilated, revealing a certain degree of urinary stasis and pyelitis. The right ureter was well delineated and though placed quite close to the vertebral column, it was within normal limits. The left kidney pelvis revealed a slight degree of hydronephrosis and the pelvis appeared to be twice as large as the one on the opposite side. There was marked dilatation of all the calyces and particularly of the two lower ones, which were rotated inward, disclosing the presence of horseshoe kidney disease. There were also marked pyelectasis, calyectasis and acute pyelitis and pyelonephritis. The outline of the left ureter was well visualized and was within normal limits. However, it appeared that the ureter was inserted high in the upper portion of the renal pelvis and there was some obstruction at the left ureteropelvic junction. (Fig. 2.)

The roentgen diagnosis was (1) fused kidney of the horseshoe type placed across the midline of the spinal column between the third and fourth lumbar vertebrae, (2) horseshoe kidney disease with marked nephroptosis, pyelectasis, calyectasis and acute pyelitis and pyelonephritis.

The patient was treated in a conservative way for about two weeks until the acute symptoms subsided in order to prepare her for operation. She received a daily intravenous infusion, high colonic irrigations and the proper medications. After all the functional tests were repeated and found approximately normal, and her general condition definitely improved, division of the renal isthmus of the horseshoe kidney was carried out as the only way to cure her, the operation consisting of the separation of the two fused organs, followed by right nephrolysis, ureterolysis and nephropexy, to relieve the acute symptoms and secure better drainage from each kidney.

FIG. 7. Bilateral retrograde pyeloureterogram of the divided horseshoe kidney after its proper surgical correction, indicating that both pelves have rotated outward and are now occupying a better position, widely apart from the midline, and that both kidneys are now properly draining.

The operation was carried out on April 21, 1939 under cyclopropane anesthesia. With the patient on her left side in position for a kidney operation, an incision about 10 cm. in length was made from the right costovertebral angle obliquely downward and then straight across to the midline of the body. The muscles and fascia were cut and the fatty capsule of the kidney exposed. Several bleeding points were clamped and ligated. The fatty capsule was opened from behind and the right kidney was readily exposed. (Fig. 3.) The dissection was carried further until the isthmus of the horseshoe kidney was clearly exposed. A small blood vessel about the middle portion of the isthmus was clamped and ligated. Then by blunt dissection the kidney was gradually loosened from its adhesions and separated from its bed, as it was found to be lying on the vena cava, aorta and other retroperitoneal structures of the midline of the abdomen. Then a kidney clamp was passed underneath the isthmus to retract and suspend it, at which time the right half of the horseshoe kidney was freely movable. Two rubber covered clamps were placed in the middle portion of the isthmus, which was then cut across with a knife. There was practically no hemorrhage. The left stump of the cut portion of the isthmus was covered with fat taken from the lumbar wound and tied with four chromic catgut sutures, passed through and through the capsule and kidney parenchyma. As the fat was tied to the raw surface of the stump of the kidney the bleeding was completely controlled. The left half was then pushed with ease to the left side away from the midline. The right half of the horseshoe kidney was sutured with fat in the same

way in order to control bleeding. After this procedure the upper pole of the right kidney was decapsulated and suspended by nephropexy, using two chromic catgut sutures tied to the capsule, and was anchored underneath the eleventh rib by placing the suspension stitch through the intercostal muscles. Another catgut suture was placed in the lower pole and anchored to the posterior sheath of the quadratus lumbaris muscle, in order to relieve the contact of the lower pole of the kidney with the right ureter, thereby eliminating the pressure and obstruction upon the peristaltic contractions of the ureter and allowing better drainage. (Fig. 4.) The operation was completed in the usual manner, the wound being closed by layers: first, interrupted sutures to the fascia; second, interrupted chromic catgut sutures to the muscle; third, interrupted chromic catgut to the fascia and muscle, and finally the skin was closed with interrupted silkworm-gut sutures. A small cigaret drain was left in the upper angle of the wound. A dressing was applied and the patient returned to her room in good condition.

The wound healed by first intention and recovery was uneventful. Before the patient left the hospital on May 9, cystoscopy and catheterization of the ureters and differential functional tests were carried out, and bilateral pyelograms taken, disclosing that the function of each kidney was within normal limits, and that the cultures were negative. The postoperative plain film and bilateral pyelograms (Figs. 5, 6 and 7) revealed that both kidneys had rotated outward to almost their normal position after division of the renal isthmus and the right nephropexy, and that the calyces, right renal pelvis and right ureter were normal in size and almost normal in position. The small degree of hydronephrosis in the kidney of the opposite side was also notably improved and caused no symptoms. Thus it was demonstrated that the conservative operation for the reconstruction of the anomalous organ, consisting of the retroperitoneal exposure and division of the renal isthmus, followed by nephropexy had relieved symptoms and restored normal function.

OPERATIVE TECHNIC FOR DIVISION OF ISTHMUS IN HORSESHOE KIDNEY

In the surgical management of division of the renal isthmus for horseshoe kidney, the operation should be performed extraperitoneally, exposing the kidney and renal isthmus by a transverse lumboabdominal incision, cutting the skin, fascia and plane of muscles, and opening the fatty capsule from behind. The peritoneum should be well retracted in order to expose the isthmus clearly, so that anomalous vessels of the isthmus can be clamped and ligated. Complete nephrolysis and ureterolysis are necessary in order to mobilize the organ. The isthmus of the fused kidney can then be lifted up and two large rubber clamps applied at its middle portion. Directly underneath the isthmus can be seen the aorta and vena cava. The renal isthmus is then divided with the knife between the two clamps, and mattress sutures are applied to its raw surfaces over fatty tissue interposed to prevent hemorrhage. This procedure will facilitate the pushing of the stump of the isthmus of the opposite kidney across the midline so that it will rotate outward to occupy its proper position on the other side of the spinal column, with assurance that there will be no bleeding, and that better drainage will be secured by its new anatomic position. The sectioned surface of the other half of the renal isthmus, corresponding to the side of the operation, is likewise covered with fatty tissue and closed with interrupted or mattress sutures to stop bleeding and also to prevent leakage of urine from the lower calyx that may have extended into the renal parenchyma of the isthmus.

Inasmuch as the operated side of the horseshoe kidney has been liberated and separated from its attachment to the isthmus and other anatomic structures, the kidney of this side is now maintained in position only by its pedicle; therefore, a new position for this half must be secured. In order to rotate the kidney upward and outward, a fixation of the organ is accomplished by a nephropexy. This conservative nephropexy for the suspension and fixation of the half of the fused kidney on the operated side consists of decapsulat-

ing the upper pole of the kidney and fixing it with chromic catgut by the capsule to the twelfth or eleventh rib, just as in any nephropexy. However, it is important also to fix the lower pole of this kidney to the lumbospinal muscles by two chromic catgut sutures (Fig. 4) in order to rotate the kidney outward and prevent it from inflicting chronic insult upon the physiologic peristaltic contractions of the ureter.

The operation can be finished in the same manner as after an ordinary nephropexy, closing the wound with or without drainage.

TABLE III

MAIN POINTS IN THE OPERATIVE TECHNIC OF DIVISION OF RENAL ISTHMUS IN HORSESHOE KIDNEY

1. A transverse lumboabdominal incision, permitting a good anatomic exposure of the renal isthmus.
2. Extraperitoneal approach to the kidney and isthmus.
3. Mobilization of the kidney and isthmus by complete nephrolysis and ureterolysis.
4. Clamping and ligation of accessory blood vessels of the renal isthmus.
5. Double clamping of the isthmus before dividing the renal parenchyma.
6. Closure of raw surfaces of the sectioned renal isthmus by mattress sutures over interposed fat to prevent hemorrhage.
7. Carrying out of a nephropexy with decapsulation of the upper pole and fixation also of the lower pole to the lateral lumbospinal muscles, in order to place the kidney that has been operated upon in a rotated position for the purpose of securing adequate drainage.
8. Closure of the wound as in an ordinary nephropexy with or without drainage.
9. Cystoscopy and bilateral retrograde pyelograms repeated two or three weeks after this unilateral operation to verify the surgical results.
10. Performance of nephropexy on the kidney of the opposite side, if this should be indicated in the check-up pyelograms, in order to relieve pain and secure good drainage from that kidney.
11. This conservative operation of division of renal isthmus and nephropexy is carried out not only to relieve symptoms but also to correct the malformation of the anomalous organ and secure adequate drainage from each of the two kidneys.

After a complete healing of the wound has been obtained by the second or third week following division of the renal isthmus, the patient should be cystoscoped and bilateral retrograde pyelograms repeated in order to verify the surgical results. If pyelographic studies reveal poor function of the kidney of the opposite side and also marked nephroptosis, nephropexy should be carried out in that kidney also, not only to relieve symptoms but also to complete the correction of the malformation of the anomalous organ and secure adequate drainage from both kidneys. (Table III.)

SUMMARY AND CONCLUSIONS

1. In the surgical treatment of horseshoe kidney, four main groups of cases must be considered, which are described in Table I.

2. The triad of symptoms that constitute the horseshoe kidney syndrome or horseshoe kidney disease is stressed and is graphically illustrated in Tables II, II-A, II-B and II-C.

3. The indications for division of the renal isthmus in horseshoe kidney are also discussed in the accompanying Tables II-A, II-B and II-C.

4. The operative technic employed, consisting of nephrolysis, ureterolysis, and division of the renal isthmus, followed by nephropexy, is described.

5. The excellent surgical results obtained indicate the value and feasibility of this conservative procedure.

6. The most important points in the technic of this operation for division of the renal isthmus in horseshoe kidney, have been summarized in Table III at the end of this paper.

REFERENCES

1. GUTIERREZ, R. The Clinical Management of Horseshoe Kidney. New York, 1934. Paul B. Hoeber, Inc.
2. GUTIERREZ, R. Horseshoe kidney, in discussion, *J. Urol.*, 27: 85–88, 1932; 32: 655–657, 1934.
3. GUTIERREZ, R. The value of indwelling ureteral catheters in urinary surgery. *Surg., Gynec. & Obst.*, 50: 441–454, 1930.
4. GUTIERREZ, R. The role of anomalies of the kidney and ureter in the causation of surgical conditions. *J. A. M. A.*, 106: 183–189, 1936.
5. GUTIERREZ, R. Anomalies of the kidney, hydronephrosis, movable kidney, injuries of the kidney. In: Cabot's Modern Urology. 3d. ed., vol. 2, chap. II, pp. 374–509. Philadelphia, 1936. Lea & Febiger.
6. FOLEY, F. E. B. The surgical correction of horseshoe kidney. *J. A. M. A.*, 115: 1945–1951, 1940.
7. PAPIN, EDMOND. Foreword from Gutierrez, Robert. The Clinical Management of Horseshoe Kidney. New York, 1934. Paul B. Hoeber, Inc.

THYROIDECTOMY*

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THE mortality rate for thyroidectomy in many of the leading clinics in this country is less than 1 per cent. This is remarkably low and speaks highly of the quality work done. One should realize that this does not represent the mass of surgeons throughout the land whose statistics are difficult to obtain. It goes without saying that the mortality is much higher and in some instances alarmingly so. My own mortality rate has been gradually lowered. The last one hundred cases have been done without any mortality, and only one death occurred in the previous one hundred cases. My excuse, therefore, in writing this paper is the hope that by describing a simple technic and emphasizing some points it may be helpful in lowering mortality for others.

In no other field of surgery is thorough knowledge of anatomy and pathology so essential. The surgeon should know where the parathyroids are located normally as well as the location of the recurrent nerve. Every surgeon can learn anatomy and I, therefore, urge him to do so before doing a thyroidectomy. (Figs. 1 to 5.)

Pathological conditions of the goiter vary greatly in different parts of the country due to variation in iodine content of the soil and water and to other factors. In this locale we seldom see a "pure" type. Practically always they are of the mixed variety. In the one microscopic section one may see normal alveoli, excessive colloid areas and even hyperplastic areas.

We believe that iodine benefits almost all patients, also Lugol's solution, 15 m. three times a day and sufficient phenobarbital for complete rest. At least two weeks' treatment in bed is insisted upon prior to any surgery.

The question of multiple operative stages is much debated. I believe that the age of the patient and the duration of the symptoms are of the utmost importance in making this decision. Many patients stand lobectomy who would die with a complete operation. It prevents collapse of the trachea, minimizes the postoperative tracheitis and prevents the incidence of severe reaction. I believe, too, that ligation operations should be done in severe cases. It is a very minor operation and gives excellent results as evidenced by increased weight, reduction of general nervousness and toxic symptoms. I also believe that this procedure reduces the mortality.

OPERATIVE PROCEDURE

Anesthesia. The choice of anesthesia is more important than is usually considered. I do practically all operations, except on children, under local anesthesia. It definitely minimizes the operation, ensures delicate handling of the tissues and prevents many of the postoperative complications such as tracheitis, bronchitis, shock and general reaction. Many of the large clinics use intratracheal anesthesia. The presence of such a foreign body in the trachea over the period of operation definitely increases tracheitis. I cannot understand why more surgeons do not adopt local anesthesia.

To administer the anesthetic a wheal is raised with a small needle and then infiltration under the skin along a line encircling the operating field. (Fig. 7.) It is usually unnecessary to use intradermal infiltration. The needle is next inserted deeply through the fascia every half inch along the posterior margin of the sternomastoid muscle to block the branches of the cervical plexus

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including the postauricular, occipital, transverse colic, acromial and clavicular branches. (Fig. 6.) Great care should be taken to draw back on the syringe each time before injection as occasionally a vein may be entered. Following infiltration through the fascia, the muscles immediately in front of the sternomastoid are injected to block off the descendens hypoglossi. The last step is injection into the superior pole. Usually about 100 cc. of 1 per cent novocain are used with three drops of adrenalin added to each ounce. Some authorities claim that the use of adrenalin precipitates a postoperative storm. I have found no such immediate or late reaction in any of my cases. After the gland is exposed, more solution is injected into the upper pole to block off the sympathetic fibers which accompany the superior thyroid artery.

Incision. The incision (Fig. 8) should be made about one inch above the sternal notch since there is a tendency for the incision to pull downward, and if it is too low it will ultimately cross the upper part of the sternum and be too conspicuous. In the average case the incision need nor be too long and a short scar gives bettet cosmetic result. However, when the thyroid gland is very large, I do not hesitate to enlarge the incision, carrying it upward toward the ear along the sternomastoid as this helps materially in exposing the upper pole of a large goiter. The incision is carried down through the skin, superficial fat and platysma but not through the fascia. Gauze is then used to assist in stripping the flap upward, using sharp dissection where necessary. The lower edge of the incision is dissected downward in the same manner. This allows better skin approximation and better exposure. The fascia is not cut in a transverse plane. The fascia is incised in the midline with a scalpel and cut with a scissors in a vertical direction from the thyroid cartilage to the

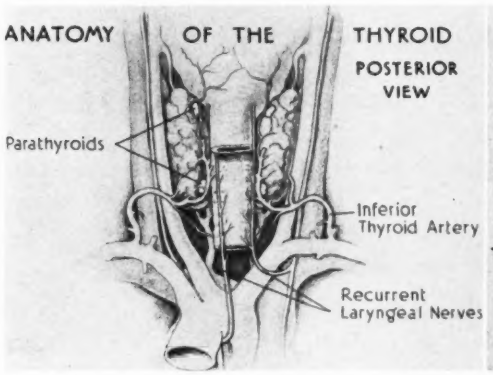


Fig. 1.

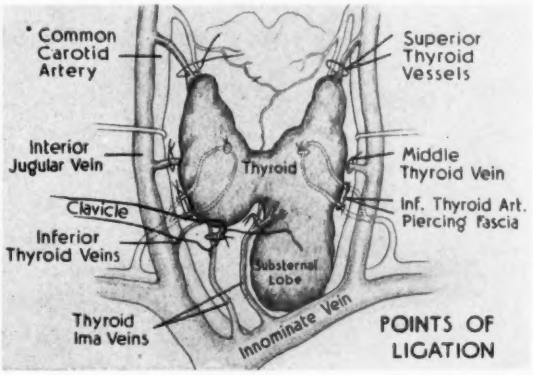


Fig. 2.

Figs. 1 and 2. Anatomical studies; self-explanatory.

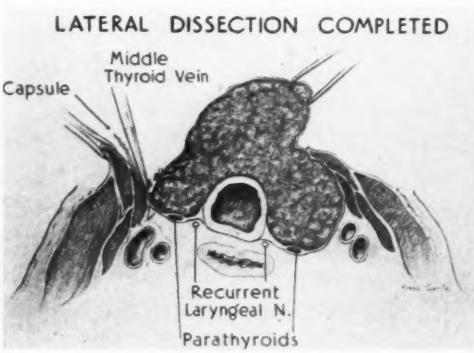


Fig. 3.

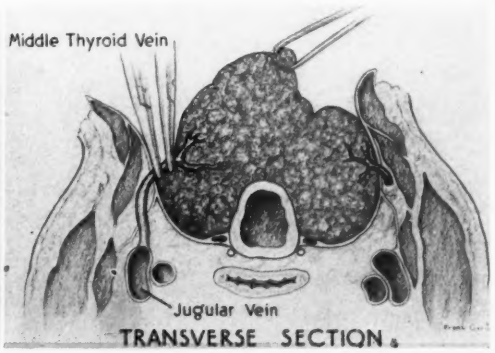
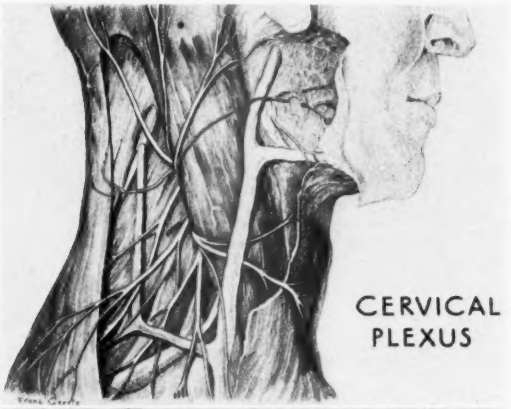


Fig. 4.

Figs. 3 and 4. Anatomical studies; self-explanatory.

episternal notch, avoiding the anterior jugular vein. The sternohyoid muscles are split vertically in the midline, exposing the gland with the two thin sternothyroid muscles covering the lobes on either side. (Fig. 9.) The sternothyroids are stripped off carefully and retracted laterally to expose the lateral edges of the lobe.



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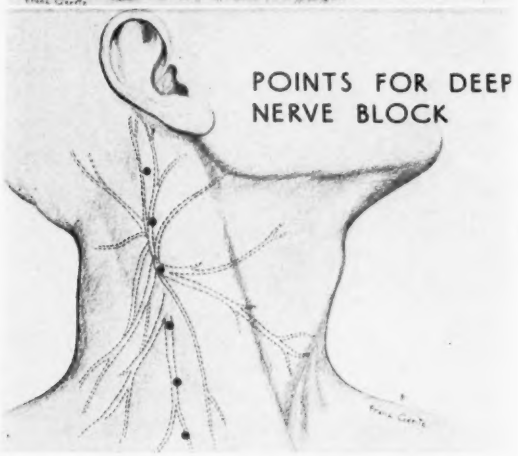

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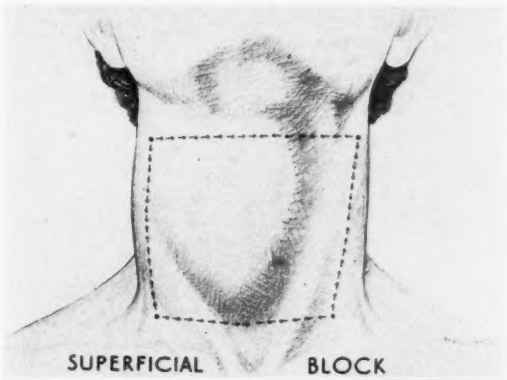
Figs. 5 and 6. Anatomical studies; self-explanatory.

Steps in Resection. The steps from this point may vary greatly in the hands of different surgeons. Each surgeon of repute has worked out details of resection to his own liking. A carefully planned operation needs to be varied only rarely and greatly facilitates the speed and smoothness of any operative procedure. Our technic is as follows:

Step 1. The upper pole is injected with novocain to anesthetize the sympathetics along the vessels. If this is not done, the patient may complain of discomfort during the operation. Dissection is begun in the groove between the upper pole of the gland and the thyroid cartilage to release the medial side of the pole. (Fig. 10.)



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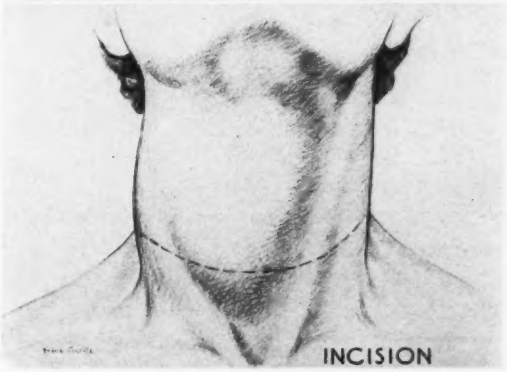

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Figs. 7 and 8. Superficial block and line of incision. In Figure 7 a circular area is infiltrated along the line indicated.

Step 2. The lateral aspect of the gland is retracted by a Percy forceps and the capsule stripped backward. The middle thyroid vein is encountered at this point, and is doubly clamped, cut and tied. (Fig. 11.) The vein enters the internal jugular vein directly and if it is allowed to retract before ligation, undesirable bleeding may occur. It is difficult to follow the proper line of capsule if this vein is not first secured. Gauze dissection is used to strip the capsule upward and posteriorly until the lateral aspect of the superior pole is cleared. (Fig. 12.)

Step 3. The upper pole is exposed by retraction and gently pulled downward, using Percy forceps. (Fig. 13.) If the thyroid gland is unusually large and extends upward, the sternohyoids may be divided. This procedure is rarely necessary but it does give good exposure in difficult

cases. A blunt aneurysm needle is used to thread No. 1 plain catgut under the pole, passing the needle from within outward to posteriorly some distance from the pole. The medial branch enters the thyroid near the trachea about half way up. It is

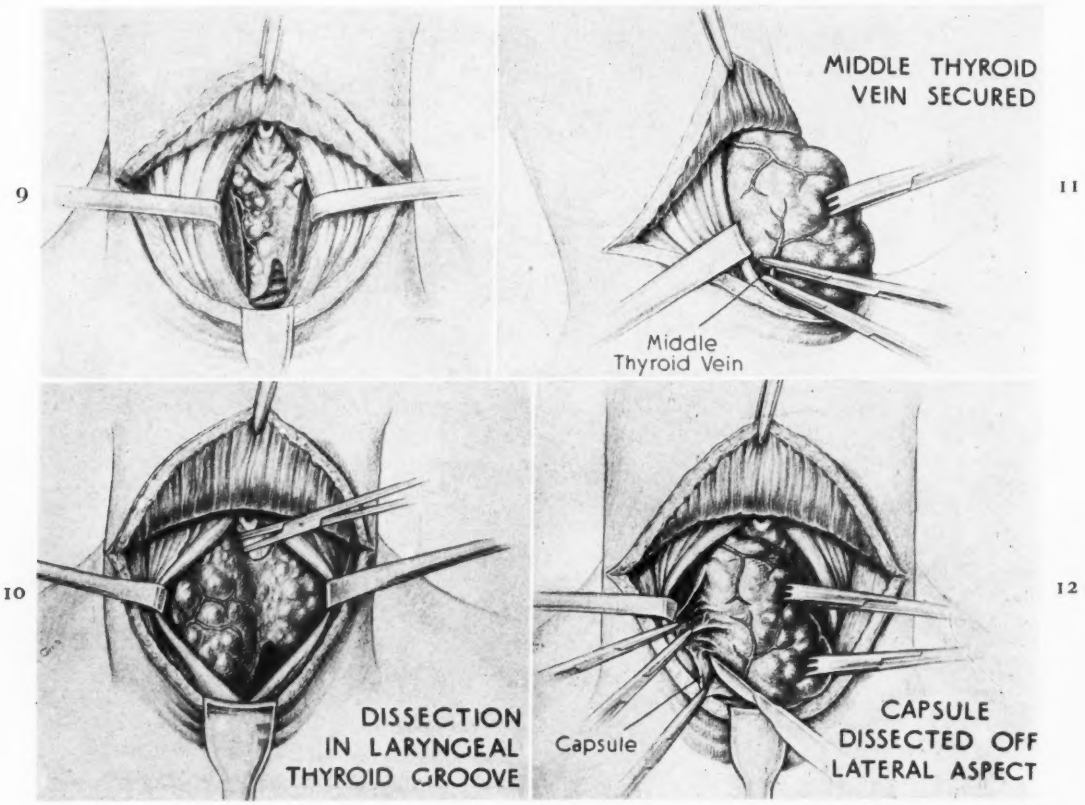

Fig. 9. Thyrohyoids and fascia have been divided, virtually exposing the isthmus and thyroid cartilage.
Fig. 10. Dissection is begun by dissecting in the groove between the upper pole and the larynx.
Fig. 11. Lateral side dissected securing the middle thyroid vein.
Fig. 12. Shows dissection of the capsule.

prevent picking up the superior laryngeal nerve. (Fig. 14.) This procedure is much simpler than using curved forceps and is accomplished with less trauma. The pole is doubly tied and divided, leaving enough tissue distal to the ligatures to ensure their safety.

Step 4. Dissection is carried around the lower pole and the inferior thyroid vessels are clamped close to the gland. It may be noted that the trunk of the main inferior thyroid artery is rarely seen. It emerges through the fascia behind the lower pole and almost immediately divides into three or more branches. One of these branches may have been encountered during dissection of the lower part of the lateral aspect. Another large branch enters the gland very necessary to remember the location of these branches and to ligate them before they can retract. Grasping for them may cause injury to the recurrent nerves and parathyroids.

Step 5. The isthmus is now divided. Sometimes this procedure is facilitated by undermining with a curved Kelly forceps. (Fig. 14.) Usually, however, the isthmus is divided in small sections by doubly clamping and cutting. When the trachea is reached the dissection is continued laterally; care is taken not to strip the trachea too clean. Usually a layer of fascia is left over it. The lateral aspect of the trachea is freed.

Step 6. The whole lobe is now lifted up to decide how much tissue should be

allowed to remain. A small portion is usually left clinging to the posterior capsule and to the groove between the trachea and esophagus. (Fig. 15.) The portion between the trachea and esophagus cover the recurrent laryngeal nerve and protects it. The amount of gland to be left is still a matter of surgical judgment. I believe that a small, relatively healthy portion of the gland is rarely found. In most cases practically all of the gland tissue is affected. If diseased tissue is allowed to remain, it may continue growing and cause all the symptoms to recur. In spite of great care there will remain a small layer of gland tissue over the recurrent laryngeal nerve area and a small portion over the trachea. For ten years I have done almost complete thyroidectomies and have had no untoward effects. It is true that in a few cases some thyroid tablets are necessary postoperatively, but these supply all necessary thyroid secretion to the body.

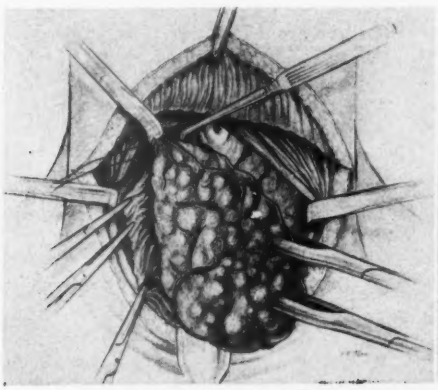

Fig. 13. An aneurysm needle carrying a ligature is passed under the upper pole.

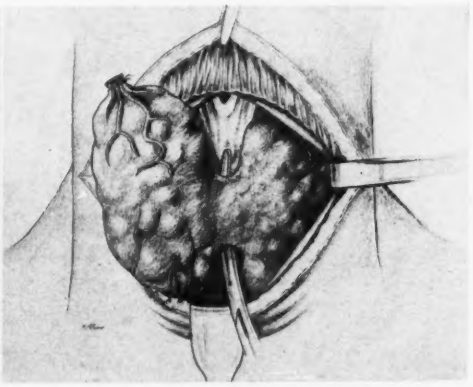

Fig. 14. After freeing the lower pole the isthmus is divided.

Careful follow-up with repeated basal metabolism tests is advisable, and I am often agreeably surprised to see the test very satisfactory when a very low metabolic rate was anticipated.

After packing the area gently the isthmus is carefully dissected off the trachea toward the other side, clearing not only the anterior aspect but a considerable portion of the lateral aspect. Resection of the left lobe is then carried out by the same procedure as used on the right.

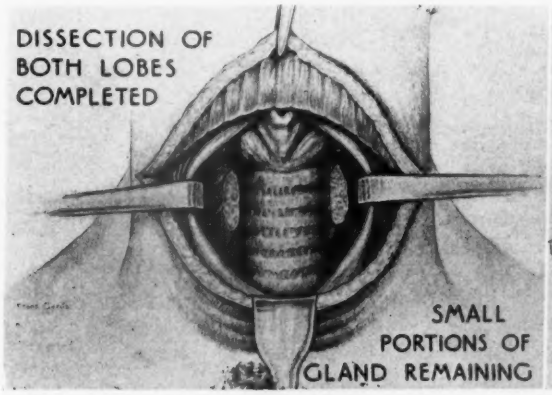

Fig. 15. Both lobes removed leaving a small portion of each.

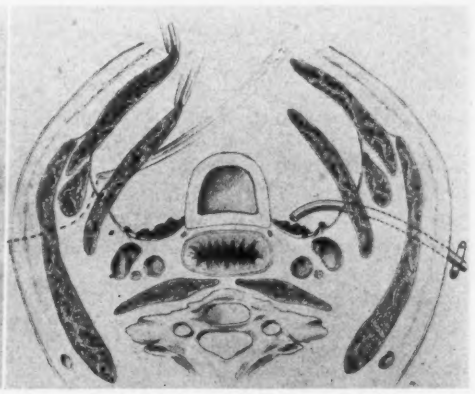

Fig. 16. Illustrates a new method of drainage. Forceps passes through the sternothyroid muscle and is carried laterally, superficial to it (along the dotted line) and through a thinned-out portion of the sternomastoid muscle. The right side of the illustration shows the tube in position.

Step 7. After making certain that hemostasis is satisfactory the next step is

to suture the layers of muscle and fascia and to establish drainage. I believe that adequate drainage is necessary for twenty-four hours postoperatively. I am aware that certain authorities do not consider drainage necessary. It is assuming the impossible to state that a wide dissection should always be free from some collection of serum. The trachea is very sensitive to changes in pressure and if clots occur they may cause swelling in the neck and collapse of the trachea. For drainage I use a soft gum-elastic tube of small size and have had no harmful effects from its use. In the past, drainage has been established through the midline. Because of this, adhesions to the trachea often developed and caused a pulling in of the skin and scar whenever the patient swallowed. I now establish drainage on each side, bringing the tube out at the lateral ends of the wound. (Figs. 16 and 19.) The tube makes its appearance behind the lateral to the sternomastoid muscle. The procedure is fraught with some danger of injury to the internal jugular vein. The following technic protects the vein: The edges of the sternothyroid muscle are held up under slight tension, using a Percy forceps. A Kelly forceps transfixes the sternothyroid muscle and is carried backward and outward in the plane between this muscle and the sternomastoid muscle and is pushed through the fascia. The tube is then pulled through. The drain for the opposite side is inserted in a similar manner.

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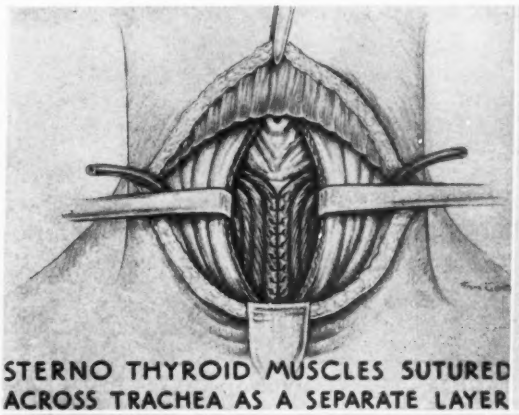

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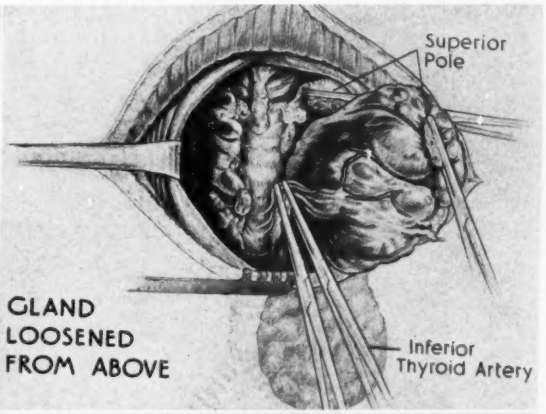

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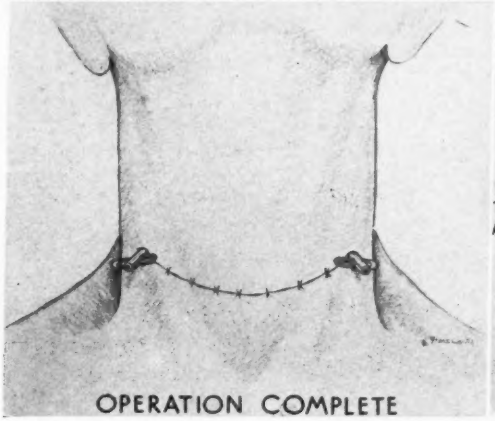

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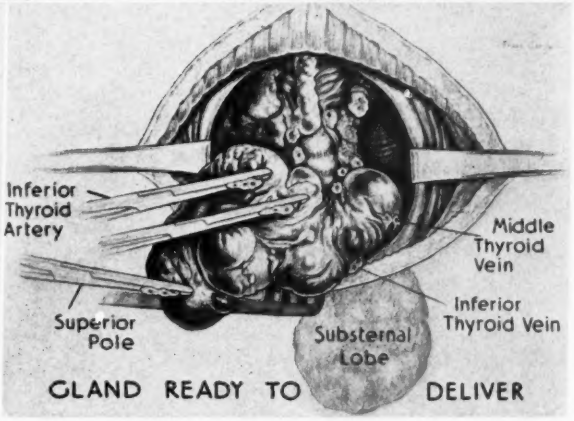

Fig. 17. The sternothyroids are sutured as a separate layer over the trachea, protecting it and preventing adhesions to the skin. Sternohyoids are next sutured.

Fig. 18. Skin is closed with skin clips and a few fine dermal sutures. Drainage tubes are shown.

Fig. 19. A substernal goiter is illustrated showing the dissection from above downward, dividing all the attachments shown in Figure 2.

Fig. 20. Substernal goiter with all attachments divided and ready for delivery.

Step 8. In the next step the thin layers of sternothyroid muscles are brought across the trachea and sutured together in this position. (Fig. 17.) This is done to protect

the trachea and prevent postoperative adhesions. The sternohyoid muscles and fascia are then sutured as one layer, using a continuous stitch. The skin, superficial fascia and platysma are brought together with large clips and to secure accurate approximation a few dermal sutures are inserted between the clips. The drainage tubes are brought out the lateral corners of the wound. (Fig. 19.)

SUBSTERNAL GOITER

If the attachments of the gland are well in mind and the gland is divided from above downward, resection of a substernal goiter is quite simple. The attachments may be enumerated as follows (Figs. 2 and 18): (1) the superior pole, (2) the isthmus, (3) the lateral aspect of the trachea, (4) the capsule of gland posteriorly and laterally, (5) the middle thyroid vein, (6) the branches of the inferior thyroid artery entering the gland on the posterior surface, (7) the fascia over the lower pole anteriorly in the neck and (8) the inferior thyroid veins. If dissection is carried out in the order given from above downward, the intrathoracic portion usually can be delivered without difficulty. (Fig. 20.) In rare instances the intrathoracic portion is very large and cannot be delivered. In this case it may be necessary to divide the gland into several portions and deliver it in sections. This procedure can be carried out safely since the blood supply has been cut off previously. This procedure is much preferable to division of the sternum which, in my opinion, should never be done in these cases.

TWO-STAGE OPERATION

The question arises as to which cases should be subjected to a two-stage operation. It is here that excellent surgical judgment is so valuable. There are no definite rules or tests to evaluate properly a patient's ability to stand surgery. In cases of old, long-standing goiter with cardiac decompensation, the operation should be performed in two stages or even three or four stages. In borderline cases it is more difficult to decide. The best criterion is the age of the patient. If the patient is past fifty years of age, the danger of the operation is magnified. I prefer a two-stage operation and a low mortality to a one-stage operation and a high mortality. I do not hesitate to do ligations as a preliminary procedure and am convinced of their value. Preoperative preparation of these patients is important. Prolonged rest in bed with phenobarbital gr. 1½ three times a day, and Lugol's solution is essential. Hospitalization for a few days preoperatively is advisable in all cases.

Edema of the legs does not always mean cardiac decompensation and may be cleared up in many cases by blood transfusion. Adherence to the above principles has enabled me to do the last one hundred cases without a death.

RECURRENT GOITERS

Cases of recurrence of the enlargement of the thyroid gland present a most serious problem since the gland is adherent everywhere and there are no natural planes of dissection. The only advice offered is to stay close to the gland and dissect slowly and carefully, as otherwise the parathyroids or the nerves may be damaged.

SUMMARY

1. Low mortality may be obtained by (a) careful selection of patients and valuation of their ability to tolerate operation, (b) careful and adequate preparation of the patient, (c) a simple and well planned operative technic, emphasizing the delicate handling of tissue and hemostasis, (d) use of local anesthesia is urged and the technic is described and (e) multiple operations are used in bad risks and definitely saves many lives.

2. A radical operation is carried out as a routine, lowering the incidence of recurrence.

3. My operative technic is described, showing a new method of closure and drainage.

ADRENAL APOPLEXY*

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ADRENAL apoplexy has come to hold an important position in the differential diagnosis of the acute condition of the abdomen in both the child and adult. In reviewing the cases which have occurred in Harper hospital, of which there were two in adults, it was thought timely to present these cases and discuss the disease and its course in the adult. Lavenson, in 1906, published an exhaustive review of the entire subject of acute adrenal insufficiency. From 1906 to 1928, Pearl and Brunn found twenty cases of acute bilateral suprarenal hemorrhage in the adult recorded in the literature. Since that time there have been twenty-two cases reported and these are listed in the following chart.

Author	Date	Age	Sex	Type	Etiology	Operation	Termination
Goldzieher	1929	..	Female	Bilateral	Thrombosis	Yes	Death
Taylor	1930	54	Female	Bilateral	.....	Yes	Death
Antonini	1931	..	.....	.....	Trauma	No	Death
Seligman	1932	31	Male	Right	Trauma	No	Death
Seligman	1932	42	Male	Bilateral	Trauma	No	Death
Seligman	1932	51	Male	Right	Trauma	Yes	Death
Seligman	1932	43	Male	Bilateral	Metastasis	No	Death
Seligman	1932	42	Female	Unilateral	Uremia	No	Death
Seligman	1932	27	Male	Left	Infection	No	Death
Seligman	1932	22	Male	Bilateral	Embolism	Yes	Death
Damon	1932	..	.....	.....	Convulsion	No	Death
Ikhteyman	1932	..	.....	.....	.....	.....	Death
Archer	1933	..	.....	Bilateral	.....	.....	Death
Chandler	1934	55	Male	Bilateral	Trauma	No	Death
Finnegan	1935	35	Female	Bilateral	.....	No	Death
Barsoum	1936	30	Male	Bilateral	.....	Yes	Death
Hall and Hemken	1936	33	Male	Bilateral	Infection	No	Death
Hall and Hemken	1936	40	Male	Bilateral	Infection	Yes	Death
Hall and Hemken	1936	18	Female	Bilateral	Pregnancy	No	Death
Hall and Hemken	1936	63	Male	Bilateral	Leukemia	No	Death
Hall and Hemken	1936	76	Male	Bilateral	Carcinoma	No	Death
Altschule	1939	72	Male	Bilateral	Thrombophlebitis	Yes	Death

OUR CASE REPORTS

CASE 1. Mr. F. B., No. 84685, white, age fifty-five years, was admitted to Harper hospital on Dr. Merritt's service October 26, 1932. He had a temperature of 96.4°F., pulse 96, respirations 24, and was drowsy, listless, irritable, and hiccoughing. Three days before admission he had fallen across a railroad track, injuring his abdomen. He remained at home and his condition became worse with nausea, vomiting, pain across abdomen and gross hematuria for two days. He had a history of chronic renal tuberculosis. On examination the abdomen was found to be tender in the epigastrium, mildly distended, free of masses and the liver slightly enlarged. Blood pressure was 120/90. The blood count was normal. The urine was found to contain tubercule bacilli and red and white blood cells. The course was rapidly downhill and the patient expired on the fourth hospital day. Autopsy examination revealed a tuberculous pyelitis with almost complete destruction of the kidney cortex, multiple miliary abscesses of the left lung, cavernous hemangioma of the liver and a massive hemor-

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rhage into the right adrenal with complete necrosis of the adrenal cortex.

Case II. Mr. C. H., No. 192171, white, age forty years, was admitted to Harper hospital on Dr. Fenech's service September 20, 1939, at 3 A.M. He was in a state of mild shock with a temperature of 97°F., pulse 70, respirations 20, and a board-like abdomen with extreme epigastric tenderness and diminished peristalsis. The patient gave a history of having suffered a sudden onset of severe epigastric pain radiating to the back, nausea, vomiting and prostration of four hours' duration. Blood pressure was 120/76, urine normal, and white blood count 16,900. Flouroscopy revealed no free air under the diaphragm or pneumonic process. He was prepared for surgery and four hours later at operation no pathological condition was found. Two days later he developed a right lower lobar pneumonia which cleared up with sulfanilamide therapy. His eyes became bloodshot. Auricular fibrillation and tachycardia, three days later, required digitalization. The course was of a progressive asthenia with temperature rising to 105°F., pulse 160, and respirations 40. The blood count on the sixth hospital day, when he became irrational and comatous, was as follows: Hemoglobin 90 per cent, red blood count 4,100,000, and white blood count 15,700. The patient expired on the seventh hospital day. Autopsy examination revealed a hemorrhage 5 cm. in diameter into the right adrenal with complete necrosis of the adrenal cortex and brown atrophy of the cardiac musculature. The left adrenal was normal.

ETIOLOGY

There have been many theories proposed as the cause of this disease in the adult. It has been definitely proved that the Waterhouse-Friderichsen syndrome of adrenal apoplexy in infancy and childhood is due to meningococcus septicemia in 60 per cent of the cases and Streptococcus hemolyticus and pneumococcus in the remaining cases. Kempf calls attention to the embryological predisposition to hemorrhage resulting from the physiological involution of the adrenal cortex. Lavenson reports two cases in which regional suppuration caused thrombosis of the suprarenal vein and consequent adrenal hemorrhage. Lavenson also calls attention to the peculiar blood supply to this organ consisting of three arteries and one vein to the hilus and suggests that simple alteration of the blood supply or blood pressure may be a factor. Severe superficial burns have been followed by hemorrhage as reported by Arnoud, Churton and Dudgeon. Simmonds suggests the presence of hemorrhagic diathesis and hemophilia. Syphilis, convulsions, leukemia and septicemia have been proposed. Trauma has been the inciting factor in cases reported by Canton, Mattei, Seligman, Damon, Chandler, Antonini and our own. Goldzieher and Gordon add to this list stasis due to compression of the vena cava between the liver and vertebral column. Altschule presented a case resulting from the idiopathic thrombophlebitis of the adrenal veins.

PATHOLOGY

Suprarenal hemorrhage may occur unilaterally or bilaterally, the latter being the most common type. Dudgeon has arbitrarily divided cases of suprarenal hemorrhage into three groups, depending upon the degree of glandular involvement: In the first group, the whole gland is converted into a blood sac with occasional extravasation into the surrounding tissues. In the second group, well marked hemorrhage into the medulla occurs with the cortex being spared. These two groups are often associated with a thrombosis of the suprarenal veins and when both glands are involved is usually fatal. The third group consists of scattered hemorrhage into the gland substance, chiefly the medulla, with little or no destruction of the parenchymatous elements. This last type is most frequently noted in the acute infectious diseases, is not usually the cause of death and is not included by some authors in the class of adrenal apoplexies.

Unilateral adrenal hemorrhages are usually of enormous size, the other gland being intact. The right adrenal is most commonly involved, probably because of the anatomical arrangement in which the right adrenal

vein comes directly off the vena cava and the left adrenal vein from the left renal vein. Grossly the adrenal is large, soft and discolored; on section, it presents a dark, homogeneous mass surrounded by a thin layer of hemorrhagic cortical tissue. The vessels to the gland are usually thrombosed. Simmonds found that the thrombi in the central veins and large branches were definitely older than those in the small branches and capillaries, concluding that thrombosis was the primary causal factor in these cases and hemorrhage secondary. Varying amounts of blood surround the gland and the hematoma may be felt through the abdomen. The condition of the other organs is variable, multiple purpuric areas in the abdominal viscera, brain and skin being not uncommon. Microscopically, there is almost complete destruction of the gland substance. Scattered islands of cortical cells and some connective tissue cells of the stroma, may be preserved but scarcely any of the nuclei are recognizable. Hemorrhagic extravasations of varying sizes are dispersed throughout the necrotic tissue.

CLINICAL CLASSIFICATIONS

Clinically, cases of adrenal apoplexy have been classified into five groups. Arnoud recognizes three groups, the first of which is the *peritoneal type* in which there is usually a sudden, severe abdominal pain and profound collapse, associated with vomiting, abdominal distention and mild lumbar and epigastric tenderness. The picture may resemble that of acute hemorrhagic pancreatitis, peritonitis and ilius; yet, the physical signs are vague and the shock is out of proportion to them. The collapse goes on to coma and the patient dies in a few days in profound depression. Such a picture has led to surgical intervention, as was deemed the proper choice in the cases of Bradnitz, Barsoum and our own. The second type, called the *asthenic type*, is characterized by a marked asthenia which progresses to a fatal termination. In the third type, *nervous* symptoms dominate the picture, being characterized by either delirium, convulsions, coma or a typhoid-like state. Lavenson has suggested a fourth type which includes cases of sudden death of infants in which nothing is found at autopsy but adrenal hemorrhage, and a fifth type in children comprising those cases which are associated with purpura of the viscera and skin. The last type is considered by most writers to be due to the severe toxemia and the adrenal hemorrhage is a manifestation of the general hemorrhagic tendency.

SIGNS AND SYMPTOMS

The signs and symptoms of adrenal apoplexy are many and this makes the diagnosis before autopsy most difficult. These can, however, be divided into two groups according to the physiology of the disease condition: Signs of acute adrenal insufficiency are rapid respirations, hyperpyrexia, rash and petechiae, gastrointestinal disturbances, such as, vomiting, diarrhea, and abdominal pain, and nervous manifestations, such as, twitching, convulsions and coma. Signs attributed to adrenal hemorrhage are shock, collapse, weak irregular pulse, cold extremities, increasing pallor, air hunger, a distended abdomen with pain and infrequently a palpable tumor in one or both kidney areas. The Sargent White line, once thought to be an important sign of adrenal disease, has now been found to be of no significance. The leukocyte count may be high and the blood pressure tends to be low.

DIAGNOSIS

The manifestation of severe abdominal symptoms with few or no physical signs in a patient who presents definite nervous manifestations, profound asthenia and gradual decline in blood pressure should suggest adrenal disease. Materna has suggested the frog pupillary reaction as an intravitam diagnostic aid in the recognition of adrenal intoxication and gives complete directions for the procedure. Unfortunately there is no pathognomonic sign.

TREATMENT

The reports of cases of adrenal apoplexy diagnosed and successfully treated are extremely rare. At the present time, treatment consists of rest, with or without sedation, the injection of adrenalin and a potent adrenal cortical extract, and a maintenance of a normal water balance and normal blood chemistry. Intravenous fluids may consist of either 5 or 10 per cent glucose solution, physiological saline or Ringer's solution. The value of desoxycorticosterone is, as yet, not reported. Blood transfusions are indicated as supportive measures. Blood plasma may be used to counteract the shock. Blood cultures should be taken and when positive, antiserum should be used along with chemotherapy. Surgery, theoretically, offers a little hope in the unilateral adrenal hemorrhage, although no patients have recovered in cases of adults, but it is apparently of no avail in bilateral cases.

CONCLUSION

In reviewing the literature from 1928 to the present time, twenty-two cases of acute adrenal hemorrhage in the adult have been reported.

Two unique cases of unilateral adrenal apoplexy in the adult occurring at Harper hospital have been presented.

An attempt has been made to present a clear-cut, clinical picture of adrenal apoplexy in the light of present day knowledge.

I wish to acknowledge the encouragement and advice of Dr. Plinn Morse, Pathologist to Harper Hospital, and of Dr. A. D. McAlpine, Chief of Surgical Staff of Harper Hospital.

REFERENCES

1. AEGERTER, E. E. The Waterhouse-Friderichsen syndrome. *J. A. M. A.*, 106: 1715, 1936.
2. ALTSCHULE, M. D. Adrenal apoplexy in man 72 years of age. *Am. J. M. Sc.*, 198: 17, 1939.
3. ANTONINI, A. A case of traumatic adrenal hemorrhage. *Endocrinol. e pat. costit.*, 6: 183, 1931.
4. ARNOUD. Quoted by Lavenson.
5. ASCHER, F. A. Case of bilateral adrenal hemorrhage. *Gyógyászat*, 73: 531, 1933.
6. BARSOUM, H. Adrenal apoplexy. *Brit. M. J.*, 2: 972, 1936.
7. BITTORF, A. Zur Kenntnis der Nebennierenerkrankingen. *München. med. Wchnschr.*, vol. 63, 1928.
8. BRUNNER, T. Massive hemorrhage of adrenals. *Deutsche Ztschr. f. Chir.*, 202: 248, 1927.
9. CHANDLER, L. R. Bilateral suprarenal apoplexy due to trauma. *S. Clin. North America*, 14: 1319, 1934.
10. CHURTON. Quoted by Lavenson.
11. CORCORAN, W. J. and STRAUSS, A. A. Suprarenal hemorrhage in newborn. *J. A. M. A.*, 82: 626, 1924.
12. DAMON, L. A. Bilateral suprarenal hemorrhage in epileptic. *Psychiat. Quart.*, 6: 438, 1932.
13. DUDGEON, L. S. The etiology, pathology, and diagnosis of adrenal hemorrhage. *Am. J. M. Sc.*, 127: 134, 1904.
14. FINNEGAN, F. R. Bilateral massive hemorrhage in instance of hyperfunction of adrenal cortex. *Am. J. Digest. Dis. & Nutrition*, 2: 504, 1935.
15. FARR, C. E. and SEMSROTH, K. Suprarenal hemorrhage. *Arch. Surg.*, 15: 627, 1927.
16. GOLDZIEHER, M. A. and GORDON, M. B. The syndrome of adrenal hemorrhage in newborn. *Endocrinology*, 16: 165, 1932.
17. GOLDZIEHER, M. A. The Adrenals. New York, 1929. MacMillan Co.
18. GRIER, M. E. and RUSSAN, B. C. Clinical and pathological presentation of case of suprarenal hemorrhage. *Nebraska M. J.*, 14: 113, 1927.
19. HALL, E. M. and HEMKEN, L. The adrenal gland, a clinical and pathological study. *Arch. Int. Med.*, 58: 448, 1936.
20. HARRIS, R. I. Hemorrhage into adrenal capsule and hemorrhage from duodenal ulcer in burn case. *Clin. J.*, 59: 150, 1930.
21. HASSELSTROM, E. and HULTEN, O. Abdominal symptoms of suprarenal hemorrhage. *Upsala läkaref. förb.*, 34: 229, 1928.
22. HEKTOEN, L. Death from hemorrhage into suprarenal bodies of boy of eighteen. *Tr. Chicago Path. Soc.*, 8: 87, 1909–1910.
23. IKHTEYMAN, I. M. Adrenal hemorrhage resulting in death. *Klin. med.*, 10: 330, 1932.
24. KEMPF, H. Uber die Bedentung der Nebennierenblutung f. der Ploezlicher. *Tod. Vierletjabrschrift Genechliche Med.*, 56: 71, 1918.
25. LAVENSON, R. S. Acute adrenal insufficiency. *Arch. Int. Med.*, 2: 62, 1908.
26. LOEB, R. F. Glandular physiology and therapy: the adrenal cortex. *J. A. M. A.*, 104: 2177, 1935.
27. LUSK, F. B. and BRUMBAUGH, A. Non-traumatic hemorrhage of suprarenals. *J. A. M. A.*, 72: 1062, 1919.
28. MATERNA, L. Autoadrenenintoxikation bei Beidenseitigen Nebennierenblutung. *Beitr. z. path. Anat. u. z. allg. Path.*, 47: 236, 1910.
29. PEARL, F. and BRUNN, H. Bilateral suprarenal apoplexy. *Surg., Gynec. & Obst.*, 47: 393, 1928.
30. ROGOFF, J. M. Glandular physiology and therapy: the adrenal medulla. *J. A. M. A.*, 104: 2088, 1935.
31. ROSENTHAL, D. B. A case of acute suprarenal hemorrhage. *Brit. M. J.*, 2: 645, 1933.

32. Sacks, M. S. The Waterhouse-Friderichsen syndrome. *Ann. Int. Med.*, 10: 1105, 1937.
33. Schroder, G. Etiology of so-called adrenal apoplexy. *Frankfurt. Ztschr. f. Path.*, 37: 128, 1929.
34. Seligman, B. Hemorrhage into adrenal in adult with special reference to hyperpyrexia. *M. J. & Rec.*, 135: 209, 1932.
35. Severn, A. G. M. Case of acute bilateral suprarenal hemorrhage. *Lancet*, 1: 647, 1923.
36. Simmonds, M. Uber Nebennierenblutung. *Virchows Arch. f. path. Anat.*, 170: 242, 1902.
37. Stewart, G. N. Adrenal insufficiency. *Endocrinology*, 5: 283, 1921.
38. Swingle, W. W. Studies of functional significance of suprarenal cortex. *Am. J. Physiol.*, 79: 666, 1927; ibid., 86: 450, 1928.
39. Taylor, G. W. Intestinal diverticulosis, pernicious anemia, and bilateral suprarenal apoplexy. *New England J. Med.*, 202: 269, 1930.

In the upper extremity . . . nonunion in the forearm, and deformity and stiffness at the wrist, are frequently the result of early and injudicious attempts to exercise, manipulate, massage, or use arms and wrists in which fractures have occurred.
From—"Wounds and Fractures"—by H. Winnett Orr (Charles C. Thomas).

MAINTAINING REDUCTION IN OBLIQUE FRACTURES OF LONG BONES*

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ONE of the fundamental principles in the treatment of any fracture is the maintenance of the replaced fragments in corrected position until callus is formed. In oblique, spiral or badly comminuted fractures of the long bones, in which it is impossible to make the ends of the fragments engage, the maintenance of position has always been a major problem. Unless some form of continued fixation is used, the bones tend to slip after reduction, resulting in overriding, malalignment and shortening. Many methods have been designed to meet this problem, as references to standard textbooks on fractures[1,2,3] will disclose. Many of the methods afford adequate reduction of fractures but have certain disadvantages from the viewpoints of the surgeon, the physical therapeutist and the patient. A few methods, simple and orthopedically sound, have proved to be entirely satisfactory. It is the object of this paper to draw attention to one of the most satisfactory procedures for managing difficult fractures of long bones.

Other methods by which this type of fracture may be reduced and the fragments controlled include operative treatment, traction and suspension. Open operation is not to be recommended, because a simple fracture is thus converted into a compound one with the danger of infection.[4] Operative reduction adds surgical trauma to a severe injury. Furthermore, the forms of internal fixation that are commonly used, such as wire sutures, Lane plates and Parham bands, are foreign materials, whose contact with bone may lead to later complications.[5,6,7] If bone grafts are used to fix the fragments, there is additional trauma and the operation is prolonged. Finally, open reduction necessitates an extensive experience in bone surgery as well as the co-operation of an exceptionally well trained operating team.

Traction and suspension methods are satisfactory in the management of these fractures. To be effective, any form of traction must have certain essentials. Once the traction has been applied, it should remain fixed without the need of constant attention and it should have no injurious effect upon other tissues. In addition, traction methods should be so simple and adaptable to given conditions that they can be used by a practitioner with limited experience in this particular field. Many of the traction methods in use fail to meet these requirements.

In skin traction, for instance, there is always a possibility that the moleskin might slip, regardless of how carefully it has been applied. "Ice tongs" or pins in the bones might become loose and, due to the motion of these foreign materials in the bones, irritation, necrosis and occasionally osteomyelitis may result. Other forms of traction require daily adjustments

* From the Fracture and Orthopedic Service of Gouverneur Hospital, Department of Hospitals, New York City. Read at the Symposium on Fractures at the American Congress of Physical Therapy, September 8, 1939, New York City and at the "Fracture Day" of the New York and Brooklyn Regional Fracture Committee, New York City, February 23, 1940.

to counteract the altered line of pull due to changes in the patient's position. These changes in position may be either voluntary or necessitated by nursing care. Traction has, in fact, been described as "dynamic energy and must be guided and varied from day to day as the position of the fragments change in response to the forces exerted on them."* In an active hospital, daily adjustment of all traction cases consumes a considerable amount of the time.

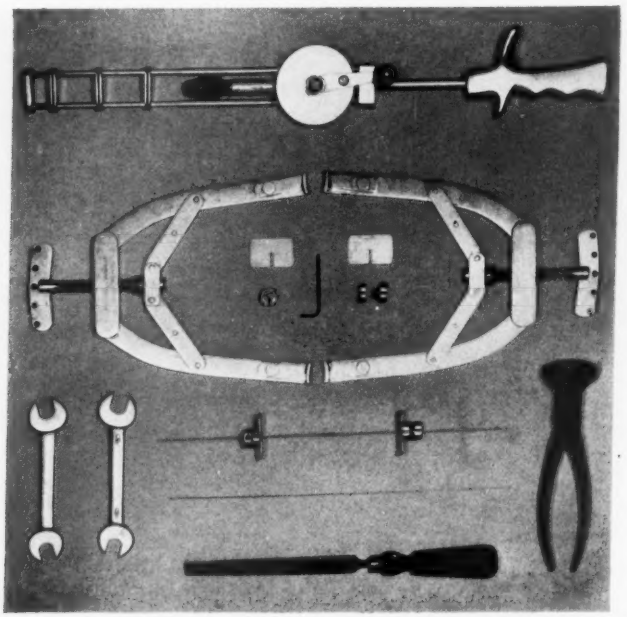

FIG. 1. These commonly used instruments, plus fracture table, *x*-ray apparatus and plaster of Paris, constitute all the equipment which is required.

Traction methods require long periods of recumbency until sufficient callus has formed to insure the retention of the fragments. This prolonged recumbency results in marked atrophy of the muscles as well as circulatory changes, which interfere with the rehabilitation of the patient. If the traction has been applied through

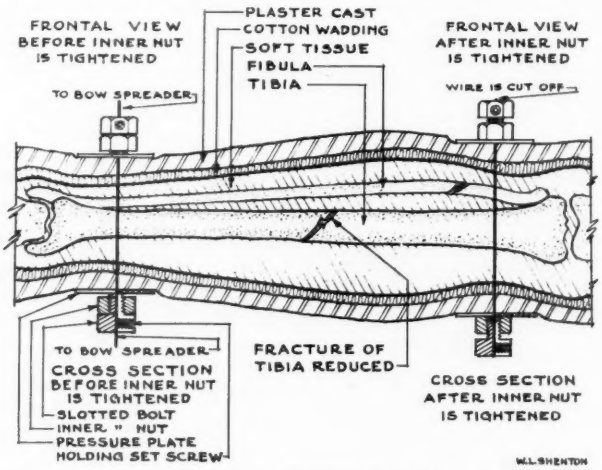

FIG. 2. Diagram showing fracture in horizontal position, as viewed on operating table, giving details of tautening bolts attached to wires.

* Key, J. A. and Conwell, H. E. The Management of Fractures, Dislocations and Sprains. 2d ed., p. 84. St. Louis, 1937. C. V. Mosby Co.

joints, the changes that take place in their supporting tissues make it difficult to restore complete function. From the patient's viewpoint, long periods of hospitalization are an economic burden.

Fig. 3. After two attempts at closed reduction elsewhere, patient came to Gouverneur Hospital.

Fig. 4. *X*-ray made on operating table during reduction.

The appreciation of the disadvantages of such methods led to the development of various forms of traction that would maintain the reduced fragments in position and remain "truly fixed."[8] Surgeons interested in the construction of mechanical appliances devised apparatus by which both reduction and adequate maintenance were possible:[9,10] Instrument makers built appliances, such as the Zimmer apparatus, which proved efficacious. Many of these, however, proved complicated and difficult to apply and the results were not always satisfactory. Then, too, the cost of such equipment often precludes its use in small hospitals or by those who seldom treat the fracture.

A stage in the development of fixed traction is exemplified by Böhler's excellent method[11] of treating oblique fractures of the tibia and fibula. Reduction is obtained on a special frame by skeletal traction through the os calcis. Modified Steinman pins are inserted above and below the site of fracture and plaster splints are carefully molded about the pins to hold them fixed. A circular plaster bandage is then applied in which the splints and pins are incorporated. This method of treatment has the advantage of permitting a patient with an uncomplicated fracture to be ambulatory and to bear weight in one week after reduction. On the other hand, Böhler's method, as well as its various modifications, has certain disadvantages in being limited to the treatment of fractures of the leg, requiring a special frame that is limited in use, special type of pins and, finally, a circular plaster casing that is heavy and cumbersome when applied over plaster splints.

Still further efforts to obviate all the difficulties in managing oblique fractures

of the long bones have resulted in the development of several satisfactory methods. One of these, which the writers

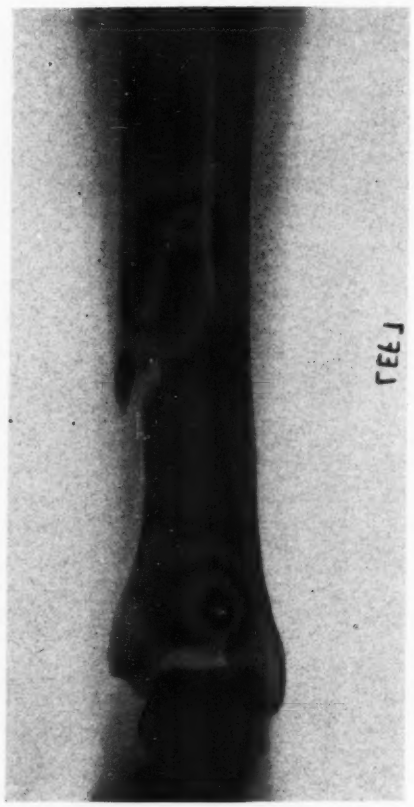

FIG. 5. Apparent distraction is due to magnification from the remote placement of the film.

advocate, is based on the use of a small tautening bolt described by Thomson and Ferciot.[12] The results have been so completely satisfactory that the method is to be recommended. It is a simple procedure, based on sound orthopedic principles,[13] that provides for fixed traction. It interferes in no way with the circulation, requires no adjustment from the time of its application and insures protection until healing has been established. From the standpoint of reduction, the method is entirely satisfactory, insuring restoration of both alignment and the length of the extremity. Joint function is preserved.[14] The equipment required, in addition to the tautening bolts, is usually available to anyone, even to those who have a limited amount of fracture work.

METHOD ADVOCATED

Equipment. The materials required are: A fracture or orthopedic table, two Kirschner wires, a drill, two spreaders, a fluoroscope or portable *x*-ray, plaster bandages, four tautening bolts with pressure plates, two ordinary end wrenches, a wire cutting plier and a file. (Fig. 1.)

Technic. At the Gouverneur Hospital, the emergency care is given by an ambulance or admitting surgeon. The fracture is adequately splinted, hemorrhage is controlled and compound wounds are properly dressed. A roentgenogram is taken to ascertain the exact nature of the fracture. An attending orthopedic surgeon is called. Then, the patient with the injured extremity—still in the original splint—is transported to the operating room. Such handling of a fracture case allows definite, and frequently final, treatment to be completed within three or four hours after the accident.

When there are no complicating factors, the patient, with the limb still in the splint, is placed on the fracture table in the operating room. Appropriate anesthesia is administered. In fractures of the lower extremity, the normal leg is attached to the traction foot piece of the table, which together with the perineal bar provides later countertraction. In fractures of the upper extremity, a body rest acts as the point of countertraction.

With the patient anesthetized and the original splint removed, the skin is prepared in routine manner. The sites for the insertion of the wires should be selected carefully, as the wires must be put in place quickly and at the first attempt. The wires should be so placed in the bone as to avoid the hematoma as well as nerves, blood vessels, epiphyseal regions and the joints. Large bow spreaders are placed on the wires, the surgeon taking care to keep the spreaders as far away from the limb as possible, in order to allow passing a plaster bandage between the spreaders and the skin surface. The spreaders are tight-

ened to render the wires taut. The spreader from the upper wire is attached to the overhead crossbar to make the upper fragment stable. If the distal wire has been placed well down the extremity—for example, in the lower tibia or in the os calcis—the spreader from this wire is attached to the fraction foot piece. If such an attachment cannot be made, traction is secured by attaching the extremity to the foot piece in the conventional manner. As traction is placed on the injured limb, countertraction is simultaneously instituted. The fragments are manipulated into position. If the fracture is a compound one, the Orr method[15] or some other appropriate treatment is carried out. The position of the fragments is checked by the fluoroscope or by a roentgenogram.

Fig. 6. Reduction completed; cast applied incorporating wires.

Fig. 7. The pressure plates and tautening bolts attached outside of cast.

Following reduction, a plaster casing incorporating both wires is applied. It should extend far enough above and below the site of the fracture to secure immobilization. The plaster is flattened around the wires where the slotted pressure plates will be applied later. When the casing is hardened, all traction is released, the spreaders are bandaged to the casing and the patient is put to bed with the limb elevated on pillows. No suspension is necessary. Within the next forty-eight hours, a second roentgenogram is taken to verify the position of the fragments. If the reduction is satisfactory, the pressure plates are placed over the wires, the tautening bolts are applied snugly against the plates and the set screws are tightened in place against the pressure plate to insure the tautness of the wire. (Fig. 2.) The spreaders are then removed. The protruding wires are cut flush with the head of the bolts to obviate any danger of injury to the patient or attendants. (Figs. 3 to 8.) As soon as the patient's general condition warrants, he may become ambulatory with the aid of crutches. (Fig. 13.)

Results. There has been no case of nonunion and no appreciable shortening in the cases which it has been possible for us to follow to the completion of treatment. Any persisting deformity has been so slight

FIG. 8. Eight weeks after reduction; sufficient callus to maintain reduction. Wires are removed.

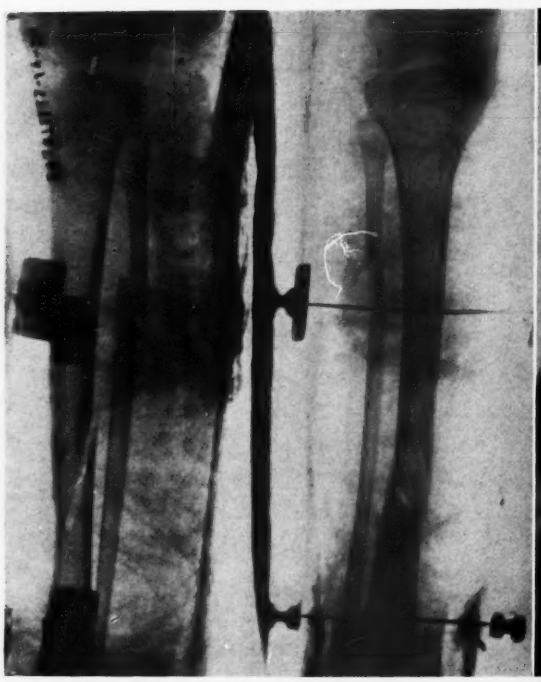

FIG. 9.

FIG. 10.

FIGS. 9 AND 10. Two cases each showing reduction with tautening bolts attached to wires. Reduction maintained by fixed skeletal traction. Tautening bolts assure continuous tension of wires.

that it has not interfered with the return of normal function. Late pain has not been a conspicuous complaint. In severe fractures of the lower tibia and fibula, the usual protracted periods of healing were encountered.

Fig. 11. Lateral view of fracture shown in Figure 12.

Fig. 12. Anteroposterior view of fracture shown in Figure 11.

In only one case was there a complication from the method. This was a persistent sinus at the site of the wire. As a rule, the sites of penetration of the wires healed promptly.

ADVANTAGES OF THE METHOD

By this method, a satisfactory reduction is obtained and the maintenance of the replaced fragments is insured, even in the most difficult fractures. The fundamental principles of the treatment of fractures are observed, in that correct alignment is obtained without subjecting injured tissues to further trauma. The plaster casing and the tautening bolts insure immobilization and prevent motion between the wires and the bones, which motion is at times responsible for bone necrosis and osteomyelitis.

The method is simple and the required equipment is usually available. Continuous, fixed countertraction is provided by the fracture table, thereby eliminating the need of both special countertraction on the upper fragment and an additional support for the knee.

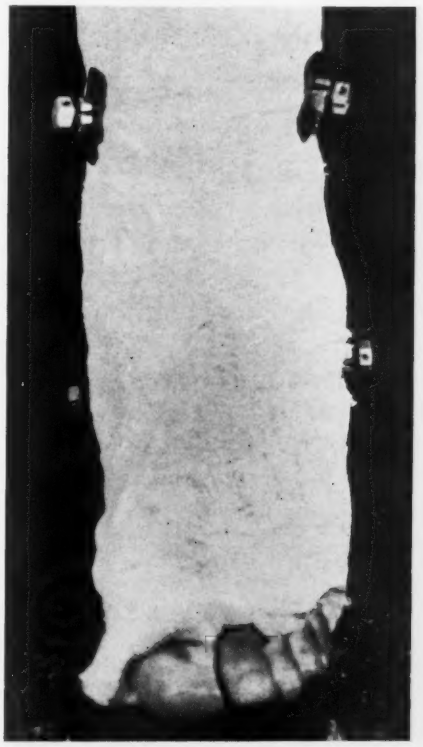

Fig. 13. Patient ambulatory with tautening bolts attached outside of cast.

Early activity stimulates the formation of callus, shortening the period of immo-

bilization. Weight bearing without protection is possible as early in this method as following any other treatment.

To the physical therapist, the great advantage of this method is the preservation of muscle tone and circulation. This is accomplished by early ambulation permitting muscular activity and frequent changes in the position of the extremity. As a result, when the patient comes to the physical therapeutist for treatment, he is in the best possible condition, in contrast with the patient who has a sluggish circulation and muscle atrophy as the result of prolonged recumbency. Early activity stimulates the formation of callus and thereby shortens the period of immobilization. It is sometimes possible to remove part of the casing after the first few weeks to permit motion of adjacent joints. In view of the patient's good condition and the advantage of beginning physical therapeutic measures early, the physical therapeutist is able to rehabilitate the patient in the shortest possible time and to restore the maximum function.

SUMMARY

A simple method has been described that insures both the reduction and the maintenance of position in oblique, spiral and comminuted fractures of the long bones. One of the great advantages of the method is its simplicity, which makes it possible for any doctor to use the procedure, even one having a minimum of equipment at his disposal.

By the use of this method, the circulation, muscle tone and joint function are preserved, thereby aiding the physical therapeutist in rehabilitating the patient and restoring normal function.

Appreciation is expressed to Dr. Walter D. Ludlum, Jr. and to Dr. Dante P. Dapolonia for the inclusion of one of their cases and to Dr. Eugene Iseppettini for some of the photography.

REFERENCES

1. Key, J. S. and Conwell, H. E. The Management of Fractures, Dislocations and Sprains. 2d ed. St. Louis, 1937. C. V. Mosby Co.
2. Wilson, P. D. Management of Fractures and Dislocations. Philadelphia, 1938. J. B. Lippincott Co.
3. Magnuson, P. B. Fractures. 2d ed. Philadelphia, 1936, J. B. Lippincott Co.
4. Eliason, E. L. and North, J. P. End results in fractures of the shaft of the femur. *J. A. M. A.*, 109: 845, 1937.
5. Mumford, E. B. Internal fixation of fractures. *Surg., Gynec. & Obst.*, 58: 194, 1934.
6. Northfield, D. W. C. On the fate of metallic foreign bodies introduced into the tissues in the treatment of fractures. *Guy's Hosp. Rep.*, 86: 159, 1936.
7. Venable, C. S. Osteosynthesis in the presence of metals. *South. M. J.*, 31: 501, 1938.
8. Orr, H. W. The treatment of fractures by means of skeletal devices. *J. A. M. A.*, 98: 947, 1932.
9 Anderson, Roger. Ambulatory method of treating femoral shaft fractures utilizing fracture table for reduction. *Am. J. Surg.*, 39: 538, 1938.
10. Carter, R. M. Fixed skeletal traction in fractures of the leg. *J. Bone & Joint Surg.*, 15: 737, 1933.
11. Böehler, Lorenz. The Treatment of Fractures. 4th ed. Baltimore, 1935. Wm. Wood & Co.
12. Thomson, J. E. M. and Ferciot, C. F. A tautening bolt for use with Kirschner wire when plaster of paris casts are used in the treatment of fractures. *J. Bone & Joint Surg.*, 18: 245, 1936.
13. Jones, Sir Robert and Lovett, Robert W. Orthopedic Surgery. 2d ed. Baltimore, 1933. Wm. Wood & Co.
14. Orr, H. W. Early and complete immobilization as a factor in the preservation of joint function in the treatment of fractures. *Am. J. Surg.*, 35: 146, 1921.
15. Ibid. Osteomyelitis and Compound Fractures and Other Infected Wounds. St. Louis, 1929. The C. V. Mosby Co.

THE DIAGNOSIS OF LOW BACK PAIN OF ORTHOPEDIC ORIGIN*

AN ANALYSIS OF SIXTY-TWO CASES

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IN spite of an extensive literature on the etiology and diagnosis of low back pain, this symptomatic disturbance continues to present itself all too frequently as a perplexing problem. Many outstanding contributions have set forth methods of etiologic classification and numerous tests and signs have been described to further accurate diagnosis. Roentgenologic technic has been modified and this medium has been used as a means of comparison with clinical findings in order more certainly to appraise the importance of the history and physical signs.

While relief of discomfort and return of function constitute the ultimate purpose of treatment, the cause of the low back pain must be determined if the proper therapeutic measures are to be applied promptly. Essentially, it must be decided whether the origin of the patient's pain is bony, articular, nervous, musculoligamentous or referred from some distant and apparently unrelated physiologic system. An attempt is then made to determine the exact area of the causative lesion and its pathologic type. It is here that the greatest difficulty arises, in spite of the array of diagnostic procedures which have been suggested from time to time. Many of these have been extremely helpful. Others have merely added to the confusion. Probably every one has added an additional hazard, namely, that of a false sense of diagnostic security. It has already been pointed out that there is no single pathognomonic sign of any definite lesion causing low back pain. In this study an attempt has been made to estimate the value of clinical signs and symptoms in the exact diagnosis of low back pain which is of orthopedic origin.

MATERIAL

These observations were made on a series of patients who presented themselves at the Backache Clinic. Of seventy consecutive patients, sixty-two cases of back pain of orthopedic origin were thoroughly studied. There were forty-four females and eighteen males. The ages varied between seventeen and seventy-three. There were three in the second decade, seven in the third, fourteen in the fourth, twenty-four in the fifth, eight in the sixth, four in the seventh and two in the eighth. The duration of symptoms ranged between one week and twenty years. In three cases the complaints were present for less than a month, in nine between one and five months, in three between six and twelve months and in forty-seven for over a year.

All cases had detailed study of the symptomatology and physical signs. The important studies in the symptomatology included the relationship of trauma and infection, the history, location, type, mode of onset and radiation of pain, together with the factors producing relief and exaggeration, the relation of pain to menses, the location of paresthesia and the character and location of stiffness with the effects of activity and change of position on this complaint.

* From the Jewish Hospital, Service of Dr. A. M. Rechtman.

The emotional factor was estimated in all cases. A detailed physical examination was made in the sitting, standing, prone, supine and side positions. Observations were made regarding the effect of posture on pain, alteration in spinal curves, range of spinal motion with production of pain, muscle spasm, condition of leg reflexes, equality of leg length, atrophy, muscular weakness, change in sensation, and areas of back, buttock, abdominal, groin and leg tenderness. Rectal examination was done in all cases. General posture and static weakness of the feet were appraised and a search was made for nodules and masses in the back and buttock. Special diagnostic tests included straight leg raising with and without dorsiflexion of the foot, Ober, Gaenslen, Nachlas, fabere and Yergason tests and the effect produced by special motions and forces such as hyperflexion and hyperextension of the back, compression of the anterior-superior spines, lateral leg bending, internal rotation of the hip, hyperextension of the hip, iliac twist and coccygeal pressure.

All patients had complete roentgenologic examinations including views of the pelvis, antero-posterior and lateral views of the dorsal and lumbar spine, a lateral view focused over the lumbosacral joint, and oblique views of the lower lumbar region. Studies were made to eliminate the possibility of urologic, gynecologic and gastrointestinal causes of low back pain. Routine blood and urine studies were made on all patients. The possibility of foci of infection in the teeth, tonsils, prostate or uterine cervix was investigated. A neurologic opinion was obtained when indicated and in one case lipiodol was used for a myelogram.

ANALYTICAL STUDY

DIAGNOSIS

The clinical diagnoses were made in the usual manner after completion of the detailed studies and were divided into two classifications: first, as to the area of the causative lesion and, second, as to the type of pathologic process thought to exist. In the area classification, thirty-two were thought to be lumbar, thirteen lumbosacral, three dorsolumbar, nine sacroiliac, two lumbar and lumbosacral and three lumbar and sacroiliac. In the type classification, forty-one were thought to be due to sprain or myofascitis, fourteen to hypertrophic arthritis, three to hypertrophic arthritis and strain, two to atrophic arthritis and strain, one to protrusion of a disc and one to osteochondritis (sacroiliac).

While a definite organic lesion was thought to be present in all of these cases, there was a significant functional element in twenty-one. In forty-one it was believed that the emotional make-up of the patient played no part whatever in the complaints.

TRAUMA

There were no acute traumatic cases such as are encountered in industrial work. The great majority of our patients had complaints of long duration and in only eight cases was there a history of an injury at the time of onset of the back pain. In four of these there was the history of a back strain and in four a fall on the back. In an additional three cases the patients recalled a fall on the back some time prior to the onset of symptoms and apparently unrelated to them. In fifty-one cases there was no history of any form of related trauma.

INFECTION

In thirty-eight patients various possible foci of infection were discovered. These occurred in the teeth in six patients, in the tonsils in fourteen, the urinary tract in two, the pelvis in two, the sinuses in one and there were multiple areas of infection present in thirteen. It was, nevertheless, our belief and the belief of our consultants that in only two of these cases was there a definite connection between the infected area and the patient's complaints. One of these was tonsillar infection and the other dental.

ASSOCIATED CONDITIONS

In fourteen patients there were associated conditions which might give rise to pain in the lower back. In eight there was a gynecologic condition present, in one an inguinal hernia, in four urologic lesions and in one a malignancy of the bowel. In all of these patients, however, we were of the opinion that there was definite and adequate orthopedic cause for the patient's complaints.

CHARACTER OF PAIN

In describing the pain, eighteen patients stated it was sudden in onset, while forty-four described it as gradual. Concerning the character of the discomfort, it was apparently dull and aching in thirty-eight, sharp and shooting in eleven and a combination of the two in thirteen. The pain came in definite attacks with free intervals in nine cases, it was steady although varying in severity in forty-two, and in eleven there was a combination of severe attacks with less severe pain in the intervals.

Relief of the discomfort was produced by rest in fifty-two of the sixty-two cases. Seven patients stated that the pain was constant and that there was no relief by any method. There was relief by lying on the back in twenty-one cases, by lying on the side opposite the discomfort in six, by lying on the side of the discomfort in four, by the erect position in two, by lying on the abdomen in four, by flexing the knees in one case and by any change of position in three cases.

Regarding exaggeration of the pain, forty-nine patients stated that it was more severe upon any form of activity. In fourteen it was increased by forward bending, in one by lying on the side of the discomfort, in three by sitting, in two by the erect posture and in six the discomfort was constant. Simple change from one position to another caused increased pain in thirty-eight cases, while change of weather was apparently an exaggerating factor in twenty-five cases. The discomfort was increased at the time of the menses in eight cases, while in thirty-six there was no apparent change at these times.

A study was made of the relationship between the character of the low back pain and the diagnosis. It was soon apparent that the various types, methods of relief and of exaggeration of pain were noted proportionately in the several diagnostic groups and were of no significant assistance in determining either the site or type of the pathologic lesion. It was noteworthy that change of weather was an exaggerating factor in similar proportion in the cases due to strain and in those due to arthritic changes.

NUMBNESS AND STIFFNESS

Fifteen patients presented subjective changes in sensation in the leg and one in the buttock. In forty-seven no disturbances of this nature were noted.

Subjective stiffness of the back was present in twenty cases and of the hip in two cases. The stiffness was noted only in the morning on arising in sixteen cases and was a fairly constant complaint in six cases. In the patients who complained of stiffness, this sensation was exaggerated by change from one position to another in nineteen, whereas in three change of position had no effect. In seventeen, the stiffness seemed to decrease with activity, while in five activity produced no change.

There was no definite relationship between the incidence of these complaints and the clinical diagnosis. There was no significant difference in the frequency with which these symptoms were found in the various diagnostic groups. Stiffness of the back was apparently more frequently noted in lumbosacral cases than in any of the others, but it was found in similar proportions of the cases of strain and those due to arthritis. Increase of stiffness by change of position and decrease upon activity were also noted equally in these latter groups.

AREA OF COMPLAINTS

In forty-five cases the patients complained of pain "in the lower back." This included the center of the lower back, one side, or both sides. In ten cases the complaint was "in the buttock," either unilateral or bilateral. In seven cases the pain was noted "in the back" or "in the middle of the back," the impression being given that it was not low in the back, although no case of pain in the dorsal region has been included in this series.

There was an interesting relationship between the area of complaints and the diagnoses. In the area classification, in *all* the lumbosacral cases the complaint was of pain in the lower back. Of the sacroiliac cases, nine of twelve patients complained of pain in the lower back, with only three in the buttocks. Of the thirty-two lumbar cases, twenty patients complained of pain in the lower back, seven of pain in the buttock and five of pain in the middle of the back. All patients complaining of pain in the middle of the back were either lumbar or dorsolumbar cases in origin. In the type classification, the complaint of pain in the middle of the back was found in four of fourteen cases of hypertrophic arthritis and in only one of forty-one cases due to strain.

LATERALITY OF COMPLAINTS

In fifteen patients the back pain was present only on the right side and in fifteen it was only on the left. Seventeen patients described it as bilateral, while fifteen stated that it was directly in the middle of the back in the line of the spinal column. In relation to the area of the lesion, the pain was unilateral in seventeen of thirty-two lumbar cases, ten of twelve sacroiliac cases and only three of fifteen lumbosacral cases. The complaint was either bilateral or in the midline of the spine in fifteen of thirty-two lumbar cases, two of twelve sacroiliac cases and twelve of fifteen lumbosacral cases. There was no significant relationship between the laterality of complaints and the type of existing pathology.

REFERRED PAIN

In thirty-five patients the pain was confined to the lower back, but in twenty-seven there was radiation to one or both lower extremities. In twenty-four the radiation was unilateral and in three it was bilateral. In twenty cases the radiation of pain was sciatic in distribution, in one case it was in the area of the outer thigh, in three the front of the thigh, in one the region of the groin and in two cases the reference occurred in the lower abdominal quadrant.

In relation to the area of the causative lesion, sciatic radiation of pain was noted in seven (22 per cent) of the lumbar cases. in four (27 per cent) of the lumbosacral cases and in nine (75 per cent) of the sacroiliac cases. The dorsolumbar cases presented no area of radiating pain. The patients with radiation to the outer thigh, front of the thigh, groin and abdomen were all thought to have lumbar lesions. In the cases with bilateral radiation of pain, one was lumbar, one lumbosacral and one sacroiliac. There was no significant difference in the relationship between the various types of causative lesions and the radiation of pain. Sciatic radiation was present in 30 per cent of the cases due to strain or myofascitis and in 30 per cent of the cases due to hypertrophic arthritis. The protruded fifth lumbar disc and the sacroiliac osteochondritis both produced sciatic pain.

LIMITED, PAINFUL SPINAL MOTIONS

In forty-three cases there was no significant limitation of spinal motion. Limitation, when present, was chiefly on anterior bending in six, on posterior bending in three, bending to the side opposite the painful area in one and limitation in all directions was noted in seven. In nine cases, anterior bending in the sitting position was definitely freer and less painful than in the erect posture. Limitation of a certain direction of spinal motion seemed

to bear no definite relationship to the diagnosis except that cases of strain seemed to be accompanied by limitation in one direction, either anterior or posterior, while those due to hypertrophic arthritis were more apt to have limitation in all directions. Similar proportions of these two groups presented no limitation whatsoever.

Improvement in the range and comfort of anterior bending occurred in the sitting position in five of twelve sacroiliac cases, two of thirty-two lumbar cases and two of fifteen lumbosacral cases.

Sixteen patients complained of no pain on spinal motion. In twenty, pain was noted in the lumbosacral area, in eighteen it was present in the buttock or posterior sacroiliac area, while in seven pain was lumbar in distribution. Leg pain was produced in only one patient upon spinal bending. Lumbosacral pain was produced in eight of fifteen lumbosacral cases, eleven of thirty-two lumbar cases and in only one of twelve sacroiliac cases. Sacroiliac pain was produced in nine of twelve cases thought to be sacroiliac in origin, in three of fifteen lumbosacral cases and in six of thirty-two lumbar cases. Lumbar pain was noted only in lumbar and dorsolumbar cases. There was no definite relationship between pain on motion and the type of causative lesion.

Passive, forced thigh flexion was painful in seven of fifteen lumbosacral cases, three of thirty-two lumbar cases and three of twelve sacroiliac cases. In all cases in which this manipulation was painful, the condition was thought to be due to strain.

POINTS OF TENDERNESS

In eight cases there were no areas of tenderness in the back or buttock. In nineteen cases there was tenderness at a single anatomic area. Tenderness was present at the lumbosacral joint in nine, over the lumbar spinous processes in three, over the posterior superior iliac spines in four, over the paraspinal lumbar muscles in two and over the lumbosacral facets in one.

In by far the largest number of patients the areas of tenderness were multiple. In general, there was no direct relationship between the area of the lesion and the points of tenderness. However, in three cases with lumbar spinal tenderness alone, all were thought to have lumbar lesions, and all were diagnosed hypertrophic arthritis. In five cases in which there was chiefly sciatic notch tenderness in conjunction with lesser points of tenderness elsewhere, all were diagnosed as sacroiliac conditions and the causative lesion was thought to be a strain.

REFERRED TENDERNESS

In addition to the areas of tenderness of the back and buttock, there were in nine patients additional tender areas which were thought to be due to referred skin sensitivity secondary to the back condition. This referred tenderness was present in the abdomen and groin alone in three cases, in the thigh and leg alone in two cases and in multiple areas in four cases. There was no relationship between the area or the type of the causative lesion and the area of referred tenderness which it produced.

There was similarly no parallel between the patients' complaints of radiation of pain and the type of referred tenderness. In five cases in which there was no radiating pain, areas of referred tenderness were determined. In only one patient with definite sciatic radiation of pain was there referred tenderness in the sciatic distribution. In sixteen patients with sciatic radiation there was no referred tenderness, in two the tenderness was in the abdomen and groin and in one it existed in multiple areas.

ROENTGENOLOGIC FINDINGS

The roentgenograms revealed lumbosacral anomalies including asymmetrical facets in twenty-eight cases, hypertrophic arthritis in thirty-seven, atrophic arthritis in one and scoliosis in eighteen. The lumbar curve was increased in seven and reduced in eleven. There was narrowing of the

intervertebral discs (excepting the lumbosacral disc) or vertical herniation of the nucleus in eight cases. Bone density was decreased in four cases. Developmental changes consisting of epiphysitis, osteochondritis and associated ligamentous calcification were noted in ten patients.

Posterior narrowing of the lumbosacral intervertebral disc was present in thirteen cases. Posterior displacement of the fifth lumbar vertebra was noted in four patients. The lumbosacral articular facets presented blurring or narrowing in seventeen cases and sclerosis in four cases. In four patients the roentgenograms revealed no abnormal findings.

Dorsal changes occurred in the roentgenograms in thirty cases, dorsolumbar changes in twenty-eight, lumbar changes in forty, lumbosacral changes exclusive of anomalies in eighteen and sacroiliac changes in six cases.

There was no definite relationship between the clinical diagnoses and the areas on the roentgenograms showing the greatest abnormality. Thus, of twenty-eight patients showing lumbosacral anomalies in the roentgenograms, only eight were diagnosed as having lumbosacral lesions. Conversely, of thirty-two patients with the diagnosis of lumbar lesions, only twenty showed this area to be the one principally involved on the roentgenogram. Of thirteen lumbosacral lesions this area was principally involved in six. Of nine sacroiliac lesions, the sacroiliac joint showed the greatest change in the roentgenogram in only one case.

LEG REFLEXES

The patellar reflexes were considered normal in all cases. The Achilles reflexes were unilaterally absent in three cases and they were diminished in two patients, one unilaterally and one bilaterally. In relation to the area of pathology, altered reflexes were noted in four lumbosacral cases and one sacroiliac case. In relation to the type of pathology, four were noted in conditions due to strain and one in the case of protruded intervertebral disc. The patient with bilateral diminution of Achilles reflexes was diagnosed as a lumbosacral strain.

STRAIGHT LEG RAISING

Straight leg raising was normal and painless in forty-six patients. There was unilateral painful limitation in eight cases and bilateral painful limitation in four cases. In four patients the range was normal, but the manipulation produced pain at the lumbosacral region in two cases and in the buttock in two cases. Limited painful straight leg raising occurred in five of thirty-two lumbar cases, in five of fifteen lumbosacral cases and in six of twelve sacroiliac cases. The very great majority of cases with limited straight leg raising were thought to be due to strain. It was noted in the protruded intervertebral disc and the sacroiliac osteochondritis. In two patients straight leg raising on both sides was limited and caused pain only on the side of the complaints. Both of these cases were thought to be sacroiliac in origin.

Dorsiflexion of the foot caused an increase in pain on straight leg raising in three of the sixteen cases. In one patient with negative straight leg raising, dorsiflexion of the foot at the normal limit produced pain in the lower back. In these four cases with pain on dorsiflexion of the foot, one was lumbosacral, one lumbar and two sacroiliac. Three occurred in cases due to strain and one in the protruded intervertebral disc.

LEG LENGTH

There were forty-nine patients with equal leg length. In thirteen cases there was asymmetry, the right leg being shorter in ten and the left leg in three. The asymmetrical cases were noted in all of the groups of the area classification in similar proportion, but it is noteworthy that in the type classification twelve were in cases thought to be due to strain and one was in the case of protruded disc. There

was no asymmetry in the cases due to arthritic changes. There was no relationship between the side of the leg shortening and the laterality of the patient's complaints.

MUSCLE POWER AND SENSATION

Muscle power of the legs was normal in all cases. While many patients presented subjective changes in sensation of the extremities, actual diminution of sensation in the thigh and leg was noted in only two cases. In neither of these did the sensory changes correspond to any definite cutaneous nerve distribution. One of the cases was diagnosed sacroiliac strain and the other lumbar hypertrophic arthritis.

ATROPHY

Atrophy of the lower extremities was determined by circumferential measurements at the upper margin of the patella and at points six inches above and below it. Atrophy was considered significant only if there was a difference in measurement of at least three-fourths inch in the thigh, one-half inch above the patella or one-half inch in the calf. In forty-one cases no atrophy was noted. There was atrophy of the thigh in seven cases, of the calf in nine, of the thigh and calf in four, and in one patient there was atrophy of the thigh with contralateral atrophy of the calf. The atrophy was right-sided in twelve, left-sided in eight, and contralateral in one case. There was no significant relationship between atrophy and either the area or type of the causative lesion. There was similarly no relationship between atrophy and the laterality of symptoms. Of six cases in which the patients' complaints were right-sided, atrophy was present in the right lower extremity in three cases and in the left in three cases. A similar situation existed when the complaints were left-sided.

Of the five patients with altered Achilles reflexes, three presented no atrophy. In one there was atrophy of the calf and in another atrophy of the thigh and calf. In six patients presenting referred leg or abdominal tenderness there was no atrophy. In the remaining three, atrophy was noted. In neither of the two cases in which there were objective changes in sensation of the extremities was atrophy seen to co-exist. There was no relationship between atrophy and inequality of leg length.

POSTURE AND FOOT STRAIN

In twenty-nine cases posture was considered essentially normal. In thirty-three it was sufficiently faulty to be suspected of playing a part in the etiology of the low back pain. Definite foot strain was present in thirty cases. The element of faulty posture was noted to be distributed evenly in the various groups of the area classification and there was no significant relationship to the type of causative lesion.

SPECIAL DIAGNOSTIC SIGNS

The Ober sign (abduction spasm or contracture with the hip in abduction and extension, the patient lying on the opposite side with the hip flexed) was positive in only one case. This patient was diagnosed as having a combined lumbar and sacroiliac strain.

The Nachlas sign (back pain upon hyperflexion of the knee with the patient prone) was not considered positive in any of our cases. The Yergason chair test (pain in the buttock on stepping upon a chair with the opposite foot) was similarly productive of no information.

Definite sacroiliac tenderness on rectal examination was noted in only three cases. Two were diagnosed as sacroiliac strain and one as a lumbar strain. Lateral leg bending, iliac twist and lateral compression of the iliac bones were of no assistance in arriving at a diagnosis.

The fabere test (flexion, abduction, external rotation, and extension of the hip) was positive in six cases. The positive cases were distributed throughout the groups of the area classification. In relation to the type of the lesion, the test was positive only in cases due to strain.

Limited painful, internal rotation of the hip was noted in two cases. Both cases were due to strain, one being lumbar and the other lumbosacral.

The Gaenslen sign (pain on hyperextension of the hip with the pelvis fixed by flexion of the opposite thigh) was positive in thirteen cases, unilateral in eleven and bilateral in two. The sign was positive in five of thirty-two lumbar cases, three of fifteen lumbosacral cases and five of twelve sacroiliac cases. It was positive in eleven cases of the forty-one thought to be due to strain and in one of the fourteen which were attributed to hypertrophic arthritis. The other positive sign was in the case of protruded intervertebral disc. In only four of the thirteen cases with a positive Gaenslen sign was this manipulation productive of pain in the area of the patients' complaints. In only five cases was the pain produced in the area in which the causative lesion was thought to exist.

The hyperextension test (pain on hyperextension of the hip with the opposite hip extended) was positive in seventeen cases, eleven unilateral and six bilateral. The test was positive in similar proportion in the various groups of the area and type classification. In nine cases this test produced pain in the area of the patients' complaints. In only five was the pain produced in the area of the causative lesion.

SUMMARY

A clinical study of sixty-two patients with low back pain of orthopedic origin resulted in the following observations:

1. Acute trauma played a minor rôle in the etiology of these cases.

2. Foci of infection were considered of little importance as causative factors.

3. The character of the pain, its mode of onset and methods of exaggeration and relief were of no assistance in determining the exact area or type of the causative lesion. Change of weather was an exaggerating feature in equal proportions in cases due to arthritis and those due to strain. Practically all were relieved by rest. The same number were relieved by lying on the painful side as on the opposite side. The majority of females found no increase in pain at the time of the menses.

4. Complaints of numbness and stiffness were of no assistance in arriving at the diagnosis. Stiffness was noted in similar proportions in cases due to both arthritis and strain. Stiffness occurred somewhat more frequently in lumbosacral lesions.

5. Regarding the area of the patients' complaints, all lumbosacral cases complained of pain in the lower back or center of the lower back. Of the sacroiliac cases, many more complained of pain in the center of the lower back than of pain in the buttock. All patients complaining of pain in the middle of the back had lesions which were lumbar or dorsolumbar. Pain in the middle of the back was noted almost exclusively in cases due to hypertrophic arthritis.

6. The greatest number of patients constituting sacroiliac cases complained of unilateral pain. The greatest number of patients in the lumbosacral cases complained of midline or bilateral pain. There was no relationship between laterality of complaints and the type of causative lesion.

7. Sciatic radiation of pain was noted in 22 per cent of the lumbar cases, 27 per cent of the lumbosacral cases and 75 per cent of the sacroiliac cases. Radiation to the outer thigh, front of the thigh, groin and abdomen was noted in lumbar cases only. The three dorsolumbar cases presented no radiation of pain.

8. The direction of limitation of spinal motion did not indicate the area of the lesion, but cases of strain were more likely to produce limitation in either the anterior or posterior direction, while arthritic cases were more apt to produce universal limitation of motion. Improvement in range and comfort on anterior bending in the sitting position did not definitely indicate but suggested a sacroiliac cause of the complaints. The area of the pain produced on spinal bending did not consistently represent the area of the causative

lesion. Pain on forced thigh flexion was noted in cases due to lumbar, sacroiliac or lumbosacral lesions, but was more frequently seen in the latter group. These cases almost invariably had a strain as the type of causative lesion rather than arthritic changes.

9. Most patients presented multiple points of tenderness. Tenderness was found most frequently at the lumbosacral joint, the posterior, superior iliac spines and in the paraspinal muscle areas. The areas of tenderness bore no definite relationship to the area or type of the lesion. Three cases with lumbar spinal tenderness alone were all diagnosed lumbar hypertrophic arthritis. Five cases with tenderness chiefly in the sciatic notch with lesser points of tenderness elsewhere were diagnosed as sacroiliac strain.

10. There was no relationship between areas of referred tenderness and the area and type of the lesion. Referred tenderness was apparently not related to the areas of referred pain.

11. There was no definite relationship between the clinical diagnoses and the areas on the roentgenograms showing the greatest abnormality. Great caution must be used in interpreting a given roentgenologic abnormality as the cause of the low back or sciatic pain.

12. Altered Achilles reflexes were noted chiefly in lumbosacral cases. All were found in cases of strain and the one case of protruded intervertebral disc.

13. Limited painful straight leg raising was of no assistance in determining the area of the lesion, but in the great majority of cases in which it was positive, the condition was thought to be due to strain. In cases of bilateral limited straight leg raising, the production of pain on the side of the complaints by raising the opposite leg suggested a sacroiliac lesion. The added test of dorsiflexion of the foot in the straight leg raising procedure was of no further aid in diagnosis.

14. There was no relationship between muscular atrophy and the diagnosis, alteration in reflexes, laterality of complaints, areas of referred tenderness or inequality of leg length.

15. The finding of faulty posture, while suggestive as a factor in the low back pain, was of no assistance in determining the area or type of the causative lesion. Inequality of leg length, however, was noted entirely in cases thought to be due to strain.

16. The Nachlas and Yergason tests were negative in all patients in this series. The Ober test, rectal examination, fabere test, and painful, limited internal rotation of the hip were of no assistance in determining the diagnosis.

17. The Gaenslen sign was positive in similar proportion in all of the groups of the area classification, but it was found almost invariably in cases due to strain. It was of no value in reproducing the area of the patients' complaints or in suggesting the anatomic area at fault. The hyperextension test was similarly of no assistance in diagnosis of the area or type of the lesion.

18. There is apparently no clinical sign, symptom, or special test, and no combination of them, which can be reliably considered as diagnostic of either the area or type of the causative lesion. Certain observations may be considered suggestive of a diagnosis.

19. The differentiation is probably almost entirely of academic interest. If intraspinal, osseous, neoplastic and remote causes are eliminated, the remaining 90 per cent of cases of low back and sciatic pain will be found to be muscular, intermuscular, articular or ligamentous in origin. Of these, regardless of the exact type or area of the causative lesion, 90 per cent will be relieved by identical, conservative, therapeutic procedures. The importance of exact diagnosis as to the area and type of the causative lesion in these strictly orthopedic cases is, therefore, limited to the 10 per cent or less which require operative procedures, such as fasciotomy, myotomy or arthrodesis to obtain relief.

REFERENCES

1. Ayers, C. E. Lumbosacral backache. *New England J. Med.*, 200: 592–608, 1929.
2. Badgley, C. E. Clinical and roentgenological study of low back pain with sciatic radiation—clinical aspects. *Am. J. Roentgenol.*, 37: 454–460, 1937.
3. Barr, J. S. The relationship of the intervertebral disc to back strain and peripheral pain (sciatica). *Surgery*, 4: 1–12, 1938.
4. Brackett, E. G. The treatment of disabilities resulting from low back derangements. *J. Bone & Joint Surg.*, 12: 325–332, 1930.
5. Brahdy, L. Mechanics of the physical signs in lower trunk injuries. *Surg., Gynec. & Obst.*, 60: 802–817, 1935.
6. Carey, E. J. The anatomy, physiology, and anomalies of the spine. *Radiology*, 9: 219–234, 1927.
7. Compere, E. L. The pathogenesis of low back pain. *West Virginia M. J.*, 35: 105–115, 1939.
8. Danforth, M. S. and Wilson, P. D. The anatomy of the lumbosacral region in relation to sciatic pain. *J. Bone & Joint Surg.*, 7: 109–160, 1925.
9. Dickson, F. D. Low back injuries with particular reference to the part played by congenital abnormalities. *South. M. J.*, 29: 364–371, 1936.
10. Ely, L. W. Backache, lumbago, pain in the lower part of the back. *Arch. Surg.*, 27: 189–202, 1933.
11. Freiberg, A. H. Sciatic pain and its relief by operations on muscle and fascia. *Arch. Surg.*, 34: 337–350, 1937.
12. Freiberg, J. A. Low back pain. *J. A. M. A.*, 113: 2195–2198, 1939.
13. Ghormley, R. K. The diagnosis and treatment of low back disability. *M. Clin. North America*, 21: 893–907, 1937.
14. Gaenslen, F. J. Low back pain. *Indust. Med.*, 4: 105–111, 1935.
15. Goldthwait, J. E. The lumbosacral articulation: an explanation of many cases of "lumbago," "sciatica," and paraplegia. *Boston M. & S. J.*, 164: 365–372, 1911.
16. Grossman, M. and Keschner, M. The sciatic syndrome. *Arch. Neurol. & Psychiat.*, 21: 398–412, 1929.
17. Hallock, H. The diagnosis and treatment of low back pain with sciatica. *S. Clin. North America*, 17: 251–277, 1937.
18. Hauser, E. D. W. Sciatic neuralgia—a clinical entity. *J. A. M. A.*, 102: 1465–1467, 1934.
19. Henry, M. O. An analysis of 100 consecutive cases of back strain. *Minnesota Med.*, 13: 572–577, 1930.
20. Heyman, C. H. Thoughts on the relief of sciatic pain. *J. Bone & Joint Surg.*, 16: 889–894, 1934.
21. Hodges, F. J. and Peck, W. S. Clinical and roentgenological study of low back pain with sciatic radiation—roentgenological aspects. *Am. J. Roentgenol.*, 37: 461–466, 1937.
22. Johnson, R. W., Jr. Posterior luxation of the lumbosacral joint. *J. Bone & Joint Surg.*, 16: 867–876, 1934.
23. Kimberly, A. G. Low back pain and sciatica—its etiology, diagnosis, and treatment. *Surg., Gynec. & Obst.*, 65: 195–216, 1937.
24. Kuhns, J. G. Low back pain. *Rhode Island M. J.*, 19: 131–143, 1936.
25. Lasègue, C. Considerations sur la Sciatique. *Arch. gén. de méd.*, 2: 558–580, 1864.
26. Mitchell, G. A. G. Lumbosacral strain. *Lancet*, 1: 75–80, 1936.
27. Naffziger, H. C., Inman, V. and Saunders, J. B. C. B. Lesions of the intervertebral disc and ligamenta flava. *Surg., Gynec. & Obst.*, 66: 288–299, 1938.
28. Ober, F. R. The role of the iliotibial band and fascia lata as a factor in the causation of low back disabilities and sciatica. *J. Bone & Joint Surg.*, 18: 105–110, 1936.
29. Pitkin, C. and Pheasant, H. C. Sacrarthrogenetic telalgia: 1. A study of referred pain. *J. Bone & Joint Surg.*, 18: 111–133, 1936.
30. Putti, V. Lady Jones lecture on new conceptions in the pathogenesis of sciatic pain. *Lancet*, 2: 53–60, 1927.
31. Rogers, M. H. and Cleaves, E. N. The adolescent sacroiliac syndrome. *J. Bone & Joint Surg.*, 17: 759–768, 1935.
32. Smith, A. De F. Differential diagnosis of conditions causing pain in the lower back. *M. Clin. North America*, 2: 1771–1776, 1937.
33. Smith-Petersen, M. N. Clinical diagnosis of common sacroiliac conditions. *Am. J. Roentgenol.*, 12: 546–550, 1924.
34. Steindler, A. Low back pain—an anatomical and clinical study. *J. Iowa M. Soc.*, 15: 473–479, 1925.
35. Von Lackum, H. L. The lumbosacral region: an anatomic study and some clinical observations. *J. A. M. A.*, 82: 1109–1114, 1924.
36. Williams, P. C. Reduced lumbosacral joint space—its relation to sciatic irritation. *J. A. M. A.*, 99: 1677–1682, 1932.
37. Willis, T. A. Low back pain—the anatomical structure of the lumbar region—including variations. *J. Bone & Joint Surg.*, 19: 745–748, 1937.

MALIGNANT SYNOVIOMA OF THE KNEE JOINT*

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TUMORS arising inside of a joint or from joint structures other than bone are rare. Steindler[8] lists the following tumors of joints: chondroma and chondrosarcoma, cartilage cysts, giant cell tumors, lipoma, fibroma and xanthoma. He further states, "Capsular hemangioma is seen in the capsule of the knee joint." von Rosen[9] also lists angiomas; and Firaud, Salmon, and Paillos[4] cite a case of myeloplax tumor of the synovial membrane of the knee. They state, "These neoplasias are not in the habit of manifesting themselves as hemarthrosis, *which is rather the finding with angiomas and malignant tumors.*" Malignant tumors of soft tissues are listed by Steindler as follows: Fibrosarcoma from fascial sheaths, fibrosarcoma from tendon sheaths, intermuscular myxoliposarcoma, synovial sarcoma, muscle sarcoma and malignant neurogenic tumors. "Synovial sarcomas are observed. The outstanding symptoms are pain, tender mass, swelling of the joint. They are radio resistant."

Knox,[5] writing in the *American Journal of Cancer* in 1936 says: "Among the malignant tumors of the extremities a relatively small group take their origin from the specialized connective tissue cells which form the synovial linings as well as from the deeper layers of fibrocytes in the walls of bursae, tendon sheaths, and the articular surfaces of the joints."

From the above paragraphs it is noted that synoviomas are not only rare, but also that they are resistant to *x*-ray therapy. They occur in tendon sheaths and bursae, also in joints. Recurrence after removal is most likely. Amputation is probably the treatment of choice provided metastasis has not already occurred. "Adenopathy almost never occurs."[2] No patient with a synovioma is known to have lived over ten years.[6]

One of the first cases of primary synovial tumor is said to have been reported by Langenbeck in 1865.[2] "In 1931 Razemon and Bizard reviewed the literature for all primary tumors of the articulations and found 74 cases. . . . There are eight well defined cases included in this report that are probably of synovial origin; of these, six were in the knee."[2] In 1927, Smith added three cases and introduced the term, synovioma.[2]

In 1935, Hodgson and Bishop,[6] of Atlanta, reported a case of malignant synovioma of the knee joint. Metastases occurred into the inguinal nodes. *X*-ray radiation did not help. The patient died seven months later. It is noted, however, that the diagnosis was made from a lymph-node and that the joint was not opened. Aspiration of the knee was done, however. Once straw-colored fluid was obtained but two days later 150 cc. of bloody fluid was found. There was a history of injury in this case to the knee joint about one year previously. The roentgenogram was said to show no evidence of any pathological condition of the bone. It does not mention whether or not there were soft tissue changes in the film. The symptoms were pain and swelling.

In 1936, Knox[5] stated that twenty-two cases of synovial sarcoma had been reported. Of these, nine occurred in the knee joint and three involved tissues lateral and posterior to the knee joint. The chief symptoms were pain and swelling of the joint. These tumors were given pathological diagnoses as follows: myxosarcoma, fuso-globo-cellulaire, villous angiofibroma, perithelioma, synovial sarco-endothelioma, and

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recently the term synovioma has been used. Berger,[1] writing on synovial sarcoma, calls these tumors reticulo-endothelio sarcomas. Histologically, he says they are reticulohistiocyto sarcomas containing a rich network of reticulo fibrils. He prefers terms similar to fibroma and fibrosarcoma and therefore suggests the term, synovialoma, for the innocent group and synovialo sarcoma for those that are malignant. The case we are presenting has been called by Dr. McBride, pathologist at Butterworth Hospital, and by Dr. Weller at University of Michigan, synovial endothelial sarcoma. Smith and Gault[6] state that the synovioma is a specific tumor arising from the serosal cells lining the joint cavities and the bursae. "In general, they may be differentiated from carcinomata by their relatively large, ovoid nuclei and the absence of the typical epithelial nucleoli. . . . Excision has been accomplished successfully in a limited number of cases. More often, particularly in those tumors arising from the joints where complete excision of the membrane of origin is technically next to impossible, recurrence has been prone to take place. Ultimately these tumors undergo malignant change and pulmonary metastasis is liable to be the end state in the clinical picture. With radical surgery, a high percentage of recovery should result. With irradiation, little or nothing may be expected other than a very transitory regression in the size of the tumor."

FIG. 1. Mrs. V. B., age thirty-five. Lateral roentgenogram of left knee showing soft tissue mass anterior to the lower end of the femur beneath quadriceps tendon. (We believe this synovioma could have been more clearly outlined and an earlier diagnosis made if air had been injected into the joint cavity prior to *x*-ray examination.)

In 1937, Coley and Pierson[2] reported fifteen cases of synovioma from the Memorial Hospital and the Hospital of Ruptured and Crippled in New York. Five of their cases occurred in the knee joint and one in the popliteal space. While it is thought that trauma is a causative factor, since about two-thirds of these cases have occurred in males, these men say that Stewart mentions the possibility that inflammatory changes in chronic synovitis might be held accountable for the neoplastic development of some of these tumors. They also mention that Wagner has called attention to the fact that if films are made for soft tissue detail, the presence of the tumor may be revealed. Both of these statements seem to be true in our case. Arthrography and arthroscopy are suggested by Giraud et al.[4] as possible aids in making a diagnosis. *X*-ray following air injection would have helped us establish a diagnosis, we believe, at the time of the first examination of our patient.

In 1938, a synovioma in the back of the knee was reported by Mallory in Boston. The patient had had pain in the knee for about seven years. The mass had been excised but a lump returned in the scar. Fifteen *x*-ray treatments did no good. Amputation was done because the pathologist said it approached a sarcomatous process. One other case, reported by von Rosen,[9] was a malignant synovioma of the knee in a man thirty-nine years of age. The patient had had symptoms for

four years. Metastases occurred late into the lymph glands, liver and lungs. Von Rosen advises early amputation to avoid local recurrences. This appears to bring the number of reported cases of synovioma in and about the knee to fifteen in the joint and five lateral and posterior to the knee.

CASE REPORT

Mrs. V. B., age thirty-five, first noticed an uncomfortable feeling in the left knee about three years before. Two years ago, following an acute attack of sinusitis, she had a gradual onset of pain in the left knee. One morning when she awakened the knee was quite distended. There was no history of injury. In September, 1938, she was seen by a medical doctor. Roentgenograms were made and said to be negative. The patient states that aspiration was not done and that she was told to rest the leg and bake it. In November, 1939, after numerous bakings, rest and walking with crutches, there was no improvement. Swelling and pain in the knee had continued. The skin over the knee was mottled from frequent bakings. The patient stated that at times the knee was more swollen and that after baking, it always seemed larger to her and there was not much relief, if any, from the pain. X-ray films were negative for pathological condition of the bone but they showed soft tissue swelling. About 200 cc. of bloody fluid was aspirated from the knee and a questionable diagnosis of angioma of the knee was made. The leg was immobilized in a cast which the patient wore for one month. Following this, there was slight improvement in the knee and exercises were begun gradually.

In February, 1940, the patient returned. Pain and swelling had recurred. At this time there was no fluid superior to the patella, but instead one could feel a soft tissue mass. A roentgenogram confirmed these findings showing the mass under the quadriceps tendon. When the two films were compared, it was believed that this soft tissue mass could also be detected in the November film. Operation was advised and was done February 14. A mass about the size of one-half an orange was found beneath the quadriceps tendon. It was partially incapsulated. There was no induration around it. Degeneration was occurring. When the knee joint was opened, bloody fluid escaped. The mass extended laterally and posteriorly involving the joint capsule. The synovia in the knee joint proper, was completely degenerated and necrotic. The bleeding points and remaining visible tags of the tumor were electrically coagulated. Rubber drains were inserted on each side of the joint because some hemorrhage was expected. This was very slight, however, and the drainage tubes were removed at the end of forty-eight hours. The patient made an uneventful recovery and was discharged on February 21. The following is a report of the pathologist, Dr. McBride:

"*Gross:* Tissue consists of multiple pieces of tissue removed from the subquadricipital bursa and measures 7 by 7 by 3 cm. The tissue is brownish in color and in some places it appears to be necrotic.

"*Microscopic:* Tissue removed from the subquadricipital area (section a) shows an infiltration of multiple dark staining irregular shaped cells. There are a few giant cells, both of the foreign body type and tumor type. Mitotic figures are few. Section from the joint cavity (section b) is made up of a similar type cell except that they are more closely packed. I believe this is a synovioma and that radical amputation is necessary."

Prepared sections were sent to Ann Arbor for confirmation: "A proliferating and infiltrating synovioma (synovial endothelial sarcoma). In my opinion it is improbable that this has already produced metastases, but it is essential that this neoplasm be completely removed and it would seem probable that this could not be secured without amputation."

Amputation was done on April 4, 1940. The tumor was found in the joint posteriorly also and extended superiorly into the muscles. In November, 1941, the patient was still well and there was no evidence of metastases.

SUMMARY

A brief history of synoviomas in the knee joint has been given. These tumors are rare. A case of malignant synovioma (synovial endothelial sarcoma) of the knee joint is here presented.

Symptoms are chiefly pain and swelling. Trauma is said to be a causative factor in many cases. In this case "chronic synovitis might be held accountable for the neoplastic development." Adenopathy is rare.

The tumor is radio resistant. Metastases occur late to the lymph glands, liver and lungs. In this case aspiration, palpation, and roentgenograms showing soft tissue detail, helped to establish the diagnosis of tumor within the joint. Pneumographic examination is suggested as an aid to diagnosis when bloody fluid is aspirated from a joint in which there is no history of recent trauma.

Recurrence is most likely in all cases. Early diagnosis is essential. If malignant changes are found, amputation is the treatment of choice.

REFERENCES

1. Berger, Louis. Synovial sarcomas in serous bursae. *Am. J. Cancer*, 34: 501, 1938.
2. Coley, B. L. and Pierson, J. C. Synovioma—report of 15 cases with review of literature. *Surgery*, 1: 113–24, 1937.
3. Hodgson, F. G. and Bishop, E. L. Malignant synovioma of the knee joint. *J. Bone & Joint Surg.*, 17: 184, 1935.
4. Giraud, Salmon and Paillos. Tumeur à myeloplaxes de la synoviale du genou. *Ann. d'anat. path.*, 16: 548–555, 1939.
5. Knox, L. C. Synovial sarcoma. *Am. J. Cancer*, 28: 461, 1936.
6. Mallory, T. B. Synovioma of knee, case records of Mass. General Hospital. *New England M. J.*, 219: 204, 1938.
7. Smith, L. W. and Gault, E. S. Essentials of Pathology. P. 282. New York, 1938. D. Appleton-Century Co. Inc.
8. Steindler, Arthur. Orthopedic Operations. Pp. 713–730. Springfield, Illinois, 1940. C. C. Thomas.
9. von Rosen, Sophus. Ein Fall von synovialem Sarkoendotheliom des Kniegelenks. *Acta orthop. Scandinav.*, 8: 191–207, 1937.

An *x*-ray of a fracture or of a part containing a suspected fracture should always be made during some period of its treatment. . . . However, a patient should not be subjected to painful handling or shifting, unsplinted, just to get an *x*-ray for record only.
From—"A Manual of the Treatment of Fractures"—by John A. Caldwell (Charles C. Thomas).

THE USE OF PENTOTHAL SODIUM FOR THE INDUCTION OF ANESTHESIA IN THYROTOXICOSIS*

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As increasing experience with intravenous pentothal sodium anesthesia has forced it into the group of recognized and desirable anesthetic agents, attention has been called in a few reports to the desirable qualities which adapt this drug especially as a basal anesthetic in the toxic hyperthyroid patient. In a group of sixty-six patients, Carraway[1] employed intravenous pentothal sodium for room induction of anesthesia prior to thyroidectomy, continuing the same anesthetic agent after removal of the patient to the operating room. Ruth, Tovell, Milligan, and Charleroy[2] used a similar method of induction of anesthesia in preparation for ten thyroidectomies, substituting inhalation anesthesia after reaching the place of operation. Murphy[3] reported a case in which a like procedure was carried out.

Every surgeon who has dealt with hyperthyroidism has had the experience of scheduling for operation a patient who appeared well prepared for thyroidectomy only to find it necessary to cancel the procedure because of the state of excitation in which the patient reached the operating room. It is in these individuals particularly that basal anesthesia is of greatest importance. Whereas, many basal anesthetic agents are available, few can be administered without the patient becoming suspicious of the procedure and surmising that operation is contemplated. Even avertin given rectally is likely to arouse suspicions in the patient's mind. On the other hand, because practically every patient with hyperthyroidism has had repeated diagnostic venipunctures, this procedure can be done without upsetting the patient or making her suspicious of the maneuver. In our clinic, in which a galactose tolerance test is done routinely in hyperthyroidism and usually repeated to determine the improvement of the patient, venipuncture becomes commonplace. On the day prior to the contemplated thyroidectomy instructions are given to the house staff, in the presence of the patient, to repeat a blood chemical examination on the following morning. On the morning of the operation the house officer, who has previously performed the venipuncture, performs another presumably to obtain a blood sample. After inserting the needle, he introduces the sodium pentothal, putting the patient to sleep before she is aware that it is being done. The induction is rapid, entirely without unpleasant qualities; and it allows the patient who has undergone thyroidectomy to awaken later in her room, oftentimes without immediate comprehension that the long dreaded ordeal has been completed. The surgeon's satisfaction in having the toxic hyperthyroid patient arrive in the operating room in the same state of physiological equilibrium in which he last saw her in her own bed is equal to that

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of the patient who has had her thyroid gland "stolen."

In a complete review of the British and American literature we have been unable to find a factual analysis of data accumulated during and following thyroidectomy performed after the use of intravenous sodium pentothal. Although impressions gained by us in the use of this anesthetic method tended to support the generalities contained in the literature, we deemed it wise to undertake a statistical study of the material in our hands in an effort to place this particular use of pentothal sodium upon a more rational basis.

For this purpose, fifty consecutive thyroidectomies performed by the Tulane Surgical Staff at Touro Infirmary were chosen for study. For half of this number anesthesia consisted of intravenous pentothal sodium induction in the patient's room, supplemented by inhalation anesthesia in the operating room; while for the remainder only inhalation anesthesia in the operating room was given. The first group, in which there were twenty-one cases of hyperthyroidism, had an average basal metabolic rate on admission of +27.1. The average basal metabolic rate in the latter group, in which were twenty-three patients with hyperthyroidism, was +32.95 on admission. Table 1 indicates the division of these cases into groups according to toxicity as indicated by the basal metabolic rate.

TABLE 1
DEGREE OF TOXICITY AS INDICATED BY BASAL METABOLIC RATE ON ADMISSION

Basal Metabolic Rate of Admission	Twenty-five Patients Receiving Inhalation Anesthesia Alone	Twenty-five Patients Receiving Intravenous Pentothal Supplemented by Inhalation Anesthesia
+60 to +100.....	3	3
+30 to +60.....	9	10
+10 to +30.....	3	6
−22 to +10.....	6	4
Not recorded.....	4	2
Average basal metabolic rate...	+32.95	+27.1

Preoperative preparation and postoperative care were essentially the same in both groups except for a necessary variation in preoperative sedation. The patients who had inhalation anesthesia alone were given preoperatively a hypodermic of morphine sulfate gr. ¼ and atropine sulfate gr. 1/150. Three patients received no other sedative; one received in addition avertin, one scopolamine gr. 1/200 hypodermically, one 6 gr. of sodium amytal, five an average of 3 gr. of nembutal, and fifteen patients received an average of 4½ gr. of seconal each. The barbiturates were given in two doses, one the night before operation, the other the morning of operation. The inhalation anesthesia consisted in each case of either ethylene or cyclopropane or both.

Of the group in which anesthesia was induced by pentothal sodium, one received 3 gr. of seconal preoperatively, nineteen received an average of ⅓ gr. of morphine sulfate hypodermically or intravenously after induction of anesthesia, and four received an average of 1/200 gr. scopolamine hypodermically after induction. One patient received no other anesthetic except .55 Gm. of sodium pentothal intravenously. The other twenty-four patients received an average of .426 Gm. of pentothal supplemented by one or more of the gases, ethylene, cyclopropane or nitrous oxide by inhalation. (Table II.)

Each patient of the group receiving pentothal was told on the day before operation that a "blood test" would be made the following morning, a procedure with which each had become familiar during the preoperative hospital sojourn. The anesthetist prepared the solution of pentothal sodium and stood outside the door of the patient's room while the intern assigned to the case made his expected entry. No patient noticed that instead of withdrawing a specimen of blood, the intern proceeded to inject a near colorless liquid. As soon as the patient

became somnolent, the anesthetist entered the room and took command of the situation. In only one instance in our group did the patient become cognizant of the meaning of this ceremony. This occurred when she was placed in a double room with a roommate for whom thyroidectomy had been done a few days previously. The secret was too good to be kept by the first occupant, and the result was that when the morning of operation arrived for the newcomer, her pulse rate and blood pressure were so advanced that the procedure was postponed. Since this occurrence we have been careful to segregate patients awaiting operation from those already past the ordeal.

Table II
IMMEDIATE PREOPERATIVE MEDICATION

Sedative	Twenty-five Patients Receiving Inhalation Anesthesia Alone	Twenty-five Patients Receiving Intravenous Pentothal Sodium Supplemented by Inhalation Anesthesia
Morphine sulfate	¼ gr. given all patients	⅕ gr. given nineteen patients
Scopolamine	1/200 gr. given one patient	1/200 gr. given four patients
Avertin	Given to one patient	
Sodium amytal	6 gr. given one patient	
Nembutal	3 gr. given five patients	
Seconal	4.5 gr. given fifteen patients	3 gr. given one patient

For the purpose of demonstrating the difference in the response of patients receiving pentothal from that of those who did not, we have chosen to tabulate average pulse and temperature readings taken at definite intervals preceding, during and in the first three days following operation. These and other interesting comparative data are set forth in the accompanying table. (Table III.)

A study of the foregoing data makes obvious a constant difference between the two groups of patients in respect to pulse rates and temperature levels obtained

Table III

	Twenty-five Patients Receiving Inhalation Anesthesia Alone	Twenty-five Patients Receiving Intravenous Pentothal Sodium Supplemented by Inhalation Anesthesia
Pulse recordings		
Average during twenty-four hours preceding operation	90.1	90.9
Early in course of operation—average	114.1	98.8
Midoperation average	123.2	122.8
Late during course of operation average	121.2	113.1
Average during first postoperative day	108.4	102.4
Average during second and third postoperative days	114.4	101.8
Temperature recordings		
Average during twenty-four hours preceding operation	98.54°F.	98.48°F.
Average during first postoperative day	100.00°F.	99.58°F.
Average during second and third postoperative days	100.47°F.	99.79°F.
Duration of operation—average	71.0 min.	78.9 min.
Average reaction time following operations	164 min.	67.97 min.
Postoperative stay in bed—average	8.04 days	5.95 days
Fatalities	One died in crisis third postoperative day	One died eighth postoperative day following cerebral accident

during and following operation. These differences, while small, are important indicators of the degree and rapidity with which these patients were able to make physiological adjustments following the physical and psychic trauma entailed in thyroidectomy. The factual evidence thus tends to bear out an impression which we had gained through clinical observation to the effect that the patients, who went to operation after room induction of anesthesia by pentothal sodium and without foreknowledge of the event, progressed through a much less stormy postoperative course than did their fellows who endured the excitation of an inhalation anesthetic induction in the operating room.

Further corroborative evidence of the salutory effect of pentothal sodium used according to this method would seem to lie in the shorter period during which it was necessary to confine this group of patients to bed. We do not attempt to draw conclusions from the fact that the one fatality during hyperthyroid crisis occurred in the control series, but record the fact in passing.

One unexpected result of our study was the comparative brevity of the reaction time in the group subjected to pentothal sodium anesthesia. An oft repeated objection to the use of pentothal has been an allegedly prolonged postoperative period of coma. Here, however, in the group receiving the intravenous barbiturate the average reaction time was less than half of that of the control series. We believe that this advantage arises because of the lessened requirement of preoperative sedation by those patients receiving pentothal. The large doses of the longer acting barbiturates which it was necessary to give preoperatively to the control group, undoubtedly had the undesirable effect of prolonging the reaction period. On the other hand, the action of pentothal sodium in the dosage employed is so short that its therapeutic action was dissipated before the end of the operative procedures.

SUMMARY

1. In a series of fifty consecutive thyroidectomies, twenty-five patients received anesthetic induction by intravenous pentothal sodium supplemented by one or more of the anesthetic gases by inhalation. The remainder were anesthetized by inhalation anesthesia alone.

2. A statistical study of these patients demonstrates in the group receiving the intravenous barbiturate a constantly lower pulse rate and temperature level during the postoperative period.

3. Unexpectedly, the accumulated data reveal a shorter postoperative reaction time in the group receiving the pentothal sodium.

REFERENCES

1. Carraway, C. N. Pentothal sodium oxygen. *South. Surg.*, 9: 313, 1940.
2. Ruth, Henry S., Tovell, Ralph M., Milligan, A. D. and Charleroy, D. K. Pentothal sodium, is its growing popularity justified? *J. A. M. A.*, 113: 1864, 1939.
3. Murphy, O. J. Pentothal sodium anaesthesia. *Brit. M. J.*, 2: 1308, 1936.

DELAYED METASTASES IN CANCER OF THE BREAST*

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INSTANCES of long delayed metastases are interesting because the reasons for the tardy manifestations of the metastases are imperfectly understood. In the present study, which has been confined to carcinoma of the breast, we have attempted in several ways, to find some factor which might offer some explanation for the wide differences in time in the appearance of metastases in several groups of cases. Our attempts have not been successful.

The literature dealing with delayed metastases consists mostly of case reports. A recent gathering is given by Willis (1934). He reviews eight papers recording delayed metastases in cancer of the breast and adds one case of his own. Among individual contributions we found Uffreduzzi's (1930) to be of special interest. He records four cases of long latency, in all of which the relation of primary to secondary growth is established almost beyond doubt by careful comparison of histological details. Three cases are cancer of the breast, with periods of latency between operation and metastatic recurrence of eleven, twelve and sixteen years, respectively.

On surveying our material on breast cancers, we found twenty-nine cases with recurrence after apparently successful operation in which we were reasonably certain as to the relation of the primary to the secondary growths, and the actual duration of the period of latency. In seven cases the recurrence occurred in the scar or in the regional lymph glands; in eleven cases there were intrathoracic and in eleven, skeletal metastases. These cases have been tabulated below in Table 1.

Three cases, that is, more than one-tenth of all cases, showed metastases appearing after a quiescence of more than five years. As a first attempt to determine whether the cases with long delayed metastases formed a group by themselves, statistical methods were used. The population represented in the foregoing table was classified according to the interval between operation and recurrence. If the presence or absence of one well defined factor would cause the relative benignity of cancer in certain cases, we would expect the whole population to be divided into two distinct groups. If, on the other hand there were but gradual and not fundamental differences between high and low malignancy, we would expect a simple distribution containing the long delayed metastases as extreme cases.

In Figure 1 the data of our material are entered. The abscissa represents the logarithm of time passed after the operation,[1] the ordinate the percentage of clinically healthy individuals within this group (i.e., of individuals with latent cancer all of whom finally presented metastases again). The points entered into this system of co-ordinates lie fairly near to a regular S-shaped curve representing a normal distribution.[2] The median value is 14.2 months (the mean is considerably higher, viz., 27.5 months), the coefficient of variation, 2.2. (Fig. 1.)

It is interesting to compare these findings with those obtained by similar surveys. Leddy and Desjardins (1935) analyzed a

[1] Here, as in many similar cases, a simpler distribution results from the use of logarithmic instead of the numerical value of time periods.

[2] A group of patients with fourteen months latency period had to be distributed proportionately to both groups.

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group of patients with supraclavicular metastases appearing after apparently successful mastectomy. In 114 patients the delay between operation and manifestation of metastatic new growth was determined. These figures have been worked up in the same way as ours and entered into value being 4 months and the coefficient variation about 2.

Statistical evaluation shows that there is probably some true difference between Pfahler's and Leddy and Desjardins' material on one side, and ours on the other. This can easily be checked. The probability

TABLE I

CASES OF METASTATIC NEW GROWTH AFTER APPARENTLY SUCCESSFUL RADICAL MASTECTOMY

Patient	Duration of Latency in Months	Localization of Metastases	Age at Operation	Presence of Metastases Verified at Time of Operation	Preoperative Rate of Growth	Histological Classification
Di	1	skin	53	yes	rapid	large duct
Ro	1	bones	51	yes	rapid	small duct
Wa	2	reg. ly. gl.	36	yes	rapid	large duct
Su	5	bones	37	yes	slow	large duct
Si	6	lungs	64	yes	moderate	large duct
Br	6	scar, reg. ly. gl.	46	yes	slow—later rapid	large duct
Wa	7	scar, reg. ly. gl.	73	yes	?	?
Gr	7	bones	42	yes	?	large duct
Br	8	pleura	79	no	?	large duct
Ni	9	bones	66	no	?	?
Ga	12	bones	48	yes	rapid	large duct
Li	12	scar	55	yes	rapid	?
Wo	13	scar, lungs	62	yes	slow	large duct
McL	14	lungs	60	no	rapid	large duct
Si	14	bones	63	yes	slow	small duct
Pi	14	lungs	63	yes	slow	large duct
Fa	14	bones	50	yes	very slow	small duct
Me	14	lungs	59	yes	rapid	large duct
Hy	18	scar	63	no	?	small duct
In	18	bones	40	no	?	?
Ge	27	lungs, ribs	47	yes	slow	large duct
Ha	37	lungs	54	no	slow	small duct
Ki	48	reg. glands	39	no	slow	?
So	48	bones	53	no	?	?
Ro	48	bones	67	no	?	?
De	54	lungs	43	no	?	large duct
Bo	78	bones	54	yes	?	?
McI	78	bones, lungs	60	no	?	?
Kl	183	pleura	33	no	?	small duct

the curve (dashed line). There, too, a normal distribution results with a median value of 7 months and a coefficient variation of 2.4. Pfahler's (1932) 933 cases, including principally local and regional recurrences, form a group characterized by the same parameters.

An earlier study of the intervals between operation and first obvious occurrence in 687 cases by Rieffel (1890) yielded much shorter periods of latencies, the median

of drawing at random a sample deviating as much as, or more than, our material from a population with parameters as found in Leddy and Desjardins and Pfahler's observations can be figured out by the λ-test (Neyman and Pearson). This probability is only about $\frac{1}{10}$ of 1 per cent. There exists, therefore, almost certainly a true difference between our group of cases and the others. The difference between the two groups is chiefly due to the eleven

cases with intrathoracic metastases. We do not know why, however, our material differs from that of other students.

All the groups studied show a simple, normal type of distribution. Thus the statistical evaluation did not reveal any evidence of other than quantitative particularities in the cases with long delayed metastases. Thus considered, the patients with long latency like Kl. (more than fifteen years) are not more outstanding than those with extremely short intervals like Di. (less than one month). Both represent extreme values of a normal distribution and, if we go a step further, their presence in a sufficiently large sample is as likely as the grouping of about half the cases in the period between seven and thirty-one months, all these events to be expected in a population characterized by a median value of 14.2 and a coefficient of variation of 2.2. We cannot, however, be certain in drawing such conclusions from the study of the distribution of the population. It is always possible and is not to be excluded by statistical methods that two groups are superimposed in such a way as to suggest a simple distribution.

We tried to approach our problem from another angle by looking for factors correlated with the duration of the latency period.

1. *Age of the Patient at the Time of Operation.* Our whole material was divided into two groups of equal size containing the patients with the shorter and longer periods of latency, respectively. The average age (at the time of operation) of the patients who had recurrences after shorter intervals was fifty-five years; of the patients with longer delay, fifty-two years. There is no appreciable correlation in our experience between the age of the patient and the period elapsing between operation and recurrence.

2. *Presence of Metastases at the Time of Operation.* In seventeen cases out of twenty-nine, the presence of metastases was verified at the operation. The periods of latency in this group varied between one month and six and one-half years, with an average of 15.6 months. In the other cases recurrences occurred after periods of between eight and 183 months with an average of forty-seven months. Accordingly, a cancer which had already metastasized at the time of operation is less likely to be kept dormant for a considerable length of time than a cancer which was removed previous to recognizable extension.

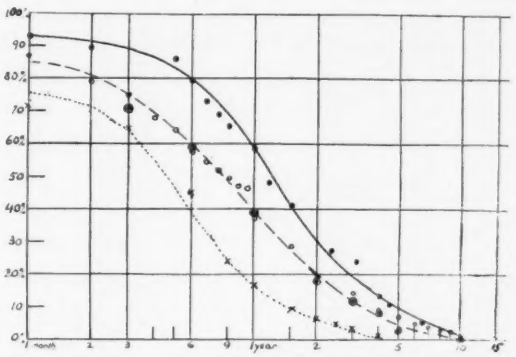

Fig. 1. *Curve:* Distribution of latency periods. *Abscissa:* Logarithm of the time elapsed between operation and first obvious recurrence. *Ordinate:* Percentage of patients with latent cancer. *Full line and circles:* Cases observed in the New Rochelle Hospital. *Dashed line and empty circles:* Patients observed by Pfahler. *Dashed line and double circles:* Patients observed by Leddy and Desjardins. *Pointed line and crosses:* Patients observed by Rieffel. The distribution of latency periods in each of the groups represented here comes very near to the simple, normal distribution. This suggests that each of the groups under consideration is a simple one, not composed by two separate groups of cases with long and short latency periods.

3. *Preoperative Rate of Growth.* In seven cases it was stated that the tumor grew rapidly before the operation. In these cases metastases occurred after periods of between one and fourteen months with an average of eight months. In ten cases it was stated that the tumor grew slowly before the operation. In these cases metastases occurred after five to forty-eight months with an average of 18.3 months. In twelve cases we had no information as to the preoperative rate of growth. Accordingly, a cancer which develops rapidly is likely to recur sooner than a cancer which grows slowly before the operation.

4. *Localization of Metastases.* In seven cases the recurrence was local or in the regional lymph glands. The periods of latency in these cases were one to forty-eight months, with an average of 13.7 months. In eleven cases skeletal metastases occurred after periods of from one to seventy-eight months with an average of 28.5 months. In eleven cases intrathoracic metastases occurred after six to 183 months with an average of 40.8 months. Local and regional recurrences appear definitely earlier than distant ones. The difference between skeletal and intrathoracic metastases in our material, however, need not be a true one. Whether distant recurrences occur later because the growth needs some time to spread, or because those distant organs are capable of keeping cancer dormant longer, cannot be decided.

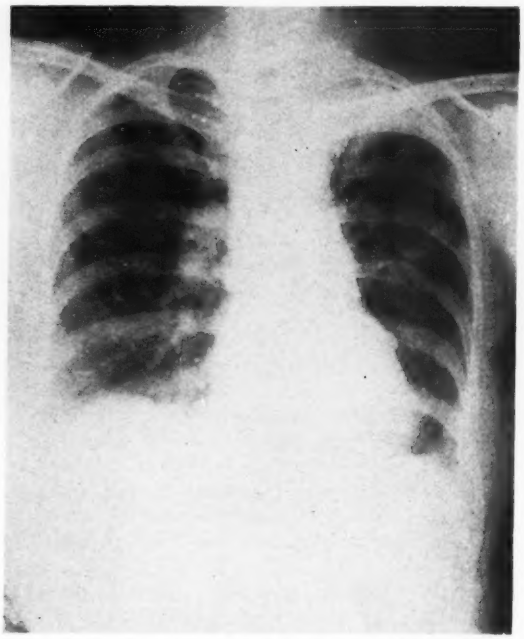

Fig. 2. Roentgenogram of patient K. L. Note thickening of pleura (left), exudate (right) and tumor shadow emerging from the left border of the heart.

5. *Histological Structure.* Twenty of our cases were examined histologically by Doctor James W. Denton.* Fourteen were classified as large duct cancers. In this group periods of latency between one and fifty-four months were observed with a median latency of 8.6 months. Six of the tumors were classified as small duct cancers. In this group the periods of latency varied between one and 183 months, the median latency being 16.7 months. Statistical evaluation by means of the λ-test revealed that this difference of latency periods between the large and small duct tumors need not be a real one and might be entirely due to random sampling.

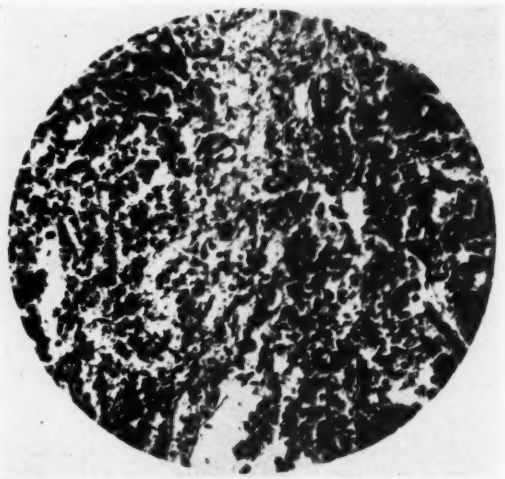

Fig. 3. Microphotograph. Mediastinal node.

The analysis of our material has shown that there are definite statistical correlations between periods of latency on one hand, and factors like preoperative rate of growth, extension of the disease at the time of operation, and localization of the recurrence on the other hand. These correlations, however, apply to groups of cases. Individual exceptions from the general rules can be found in considerable quantities.

As a third approach to the problem of delayed metastases, cases recorded in the literature were surveyed with the object of discovering some common traits. We were not able to detect any such factor.

1. *Age.* Advanced age is recorded in several cases (Ganz, Huguenin and Gillet, Pfahler), but several patients were in the forties at the onset of the disease (Ginsburg, Uffreduzzi). Our patient Kle. was only thirty-three years old when first operated upon, and Uffreduzzi's patient Case No. 3 about thirty years old when she first

* Pathologist of the New Rochelle Hospital.

noticed the tumor. There is no specific age for long delayed metastases.

2. *Extent.* Some patients were operated upon in the first stage of the disease, but all of Uffreduzzi's three cases had metastases in the axillary lymph-nodes, which were histologically verified, and his Case No. 3 presented lesions in both breasts. Consequently, cancer can be kept latent for a long time even if the disease has previously reached advanced stages.

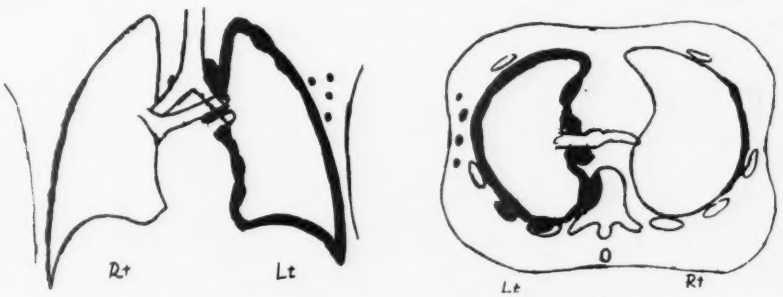

Fig. 4. Half-schematic drawing showing the distribution of cancerous growth in patient K. L. Heavy lines indicate cancerous involvement of the left pleural cavity extending from the mediastinum to the apex, down along the costal surface to the diaphragm and along the diaphragmatic pleural layers to the left half of the pericardium, some ribs and vertebral bodies and mediastinal and axillary nodes. There was a doubtful involvement also of the right pleural cavity indicated by thinner lines. *a*, Frontal section; *b*, transversal section.

3. *Localization of Recurrence.* Cases with late local and regional recurrences are recorded (Ganz, Uffreduzzi, Pfahler, Williams (No. 2) Leddy and Desjardins, Barling) as well as skeletal (Ginsburg, Willis, Cameron, Lewin), intrathoracic (Curtis, Graham, Huguenin, Uffreduzzi (No. 1), Williams (No. 1), our case), and intra-abdominal metastases (Uffreduzzi (Nos. 2 and 3), Graham, Bell and Datnar). The power of keeping cancerous growth latent is not restricted to any organ or tissue.

4. *Histological findings* are difficult to compare as exactness of description and nomenclature vary. But it is evident that there are at least several different histological pictures found in cases with long latency. Uffreduzzi's three cases are diagnosed as cystadenoma papilliferum, scirrhus, cystadenoma simplex; our case was reported first as medullary cancer, the recurrence as small duct cancer with occasional attempts to formation of glandular structure; Leddy and Desjardins' two cases are recorded as grade IV cancers. Very dense and hyalinized fibrous tissue is mentioned in Huguenin and Gillet's and in our case.

5. *Rate of Growth.* In two cases (Uffreduzzi's No. 3, Williams' No. 2) it is stated that the tumor was present for ten years before the operation with no period of rapid growth. In most of the cases the preoperative rate of growth is not stated.

Reviewing the results of this survey we concede that it was not possible to separate cases with long delayed metastases from the bulk of the other breast cancer cases by the methods of statistical evaluation of the periods of latency. Correlation of various details, as age, extent, etc., with periods of latency yielded no definite result. We do know that cases in which the tumor had grown slowly and without spread beyond the primary site before the operation are likely to show recurrences (if such occur) later than cases with rapidly growing tumors operated upon in advanced stages. About the same applies to histological findings. We know of many details which characterize the higher or lesser degrees of malignancy in neoplastic disease; but here, as with clinical and anatomical data, the correlation between the detail

observed and the degree of malignancy as measured by the period of latency or the total survival, is also only a statistical one. Rules concerning the malignancy and the presence or absence of certain known factors apply only to groups of cases. There is no rule to which there do not exist numerous individual exceptions.

Undoubtedly, investigations concerning higher or lower degrees of malignancy in breast cancer have not yet gone very far beyond a survey of the problem. With our present knowledge it seems that the degree of malignancy in a given case of breast cancer depends either on one unknown factor or on the combination of a great variety of factors. Under these circumstances it seems worth while to record case histories of patients with outstandingly high or low degrees of malignancy of breast cancer. On the basis of such material, some future survey may come to more definite conclusions than were obtained in this study. In the following paragraphs we present the case history of the patient with the longest period of latency we have observed.

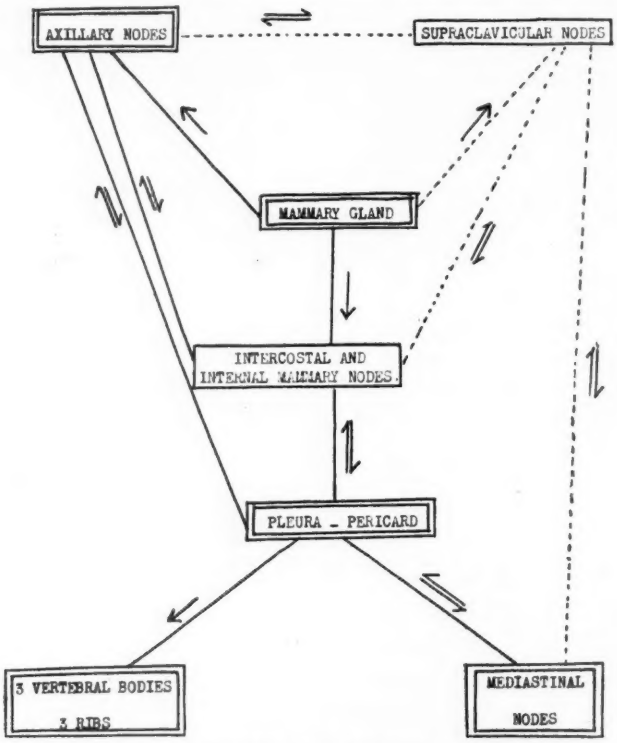

FIG. 5. Schematic drawing showing various possible ways of propagation of cancer in patient K. L. Framing by double outline indicates that cancerous involvement has been demonstrated. Framing by single outline indicates that no special examination at this place was done but that cancerous involvement may be assumed. Plain arrows indicate the direction of extension; double arrows are set where extension was possible in both directions.

CASE REPORT

Miss Kl. was operated upon at the age of thirty-three years, in January 1925, by Dr. A. A. Berg. A radical amputation of the left breast was done. The pathological report was: Medullary carcinoma, axillary nodes not involved.

Patient was apparently in her usual health until April, 1940, at which time she developed pain in the right upper chest accompanied by some difficulty in breathing, mainly on exertion. Physical examination at that time showed no abnormalities in the lungs. The heart was not enlarged, there was a very soft systolic murmur at the apex, rhythm was

normal, blood pressure was 140/90, but pulse was 100. Temperature was normal. Blood count was normal with the exception of 11,250 white cells. Urine examination was negative. Basal metabolism test was a minus 6. *X*-ray of chest showed some thickening of the left pleura, at apex and base, and a dense shadow with a convex outline emerging from the left border of the heart shadow. A few days later the patient developed severe pain in the right chest, posteriorly, which was diagnosed as dry pleurisy, and she was admitted to the hospital. (Doctor C. C. Guion's service.)

Following admission the patient had low fever for only about ten days. The pulse remained rapid, ranging between 100 and 120. Dyspnea was unchanged and at times there was moderate cyanosis. The physical signs of dry pleurisy continued although radiographic examination at one time showed a small amount of fluid present.

On radiological examination, thickening of the left pleura was visible, especially in the apical region and at the base. A dense shadow with convex outline which could not be explained satisfactorily was visible emerging from the outline of the left ventricle. At autopsy, it was identified as a tumor deposit in the pericardium. On the right side, signs of pleural effusion were noted. (Fig. 2.)

At fluoroscopy, the movements of the left half of the diaphragm were delayed indicating that the inhibition was mechanical in origin and not due to nerve disturbance since there was no paradoxical movement. It was seen at the autopsy examination that the left phrenic nerve was completely ensheathed by neoplastic growth. It could not be found, in fact, within the tumor masses. Under such conditions, we would expect phrenic paralysis. The same, by the way, applies also to the left recurrent nerve. No hoarseness had previously indicated impairment of its function, and at the autopsy examination the nerve could not be found in the tumor masses.

This condition remained stationary until the end of six weeks when the pulse suddenly became weaker and death followed.

The autopsy by Doctor *Denton* revealed more extensive lesions than the clinical findings had indicated. The head and neck were not examined because there was no clinical evidence of involvement of the central nervous system.

The subject was unusually pale but well nourished. The axillary fat on the left side contained several hard, tumorous lymph-nodes. There was extensive tumor infiltration of the left half of the mediastinal tissues, the mediastinal pleura and the adjacent pericardial wall being fused in a dense mass. The left vagus and phrenic nerves were undoubtedly involved in these tumorous adhesions but could not be discovered after diligent search. The left pulmonary vessels were narrowed and distorted.

The left parietal pleura was extensively infiltrated and adherent to the lung throughout. The right pleural cavity contained no fluid but the surfaces were covered with recent fibrin deposits.

There was no tumor infiltration of either lung. The right lung was of normal volume. The left was fibrous and of decreased volume, due apparently to tumorous infiltration about the left pulmonary vessels. The heart was normal. Tumorous deposits were found in the left third, fourth and sixth ribs and in the left sides of the bodies of the third, fourth and fifth dorsal vertebrae. These deposits in the bones were not recognizable radiographically.

The abdominal organs showed nothing significant. The organs were somewhat small and atrophic.

Histological examination of the pleurae, diaphragm, pericardium and axillary nodes showed small islets of alveolar carcinoma of mammary type. There was marked fibrous reaction about the islets of tumor cells. (Fig. 3.)

The half schematic drawing—a transverse and a frontal section—shows the extension of the new growth. (Fig. 4.)

The anatomical and histological findings suggest very strongly that the neoplasm was secondary to the previously found cancer of the breast. Both the intrathoracic and the axillary lymph-node localization are typical of metastasis secondary to breast cancer, as is the histological structure of the tumor. We are, therefore, reasonably certain in diagnosing the condition as metastasis from a breast cancer even without being able to compare

the histological structure of primary growth and metastases.

The path of extension cannot be traced with certainty. The scheme (Fig. 5) shows that various ways of spreading could have produced the distribution of cancerous growth as found on autopsy.

The massive and dense thickening of the serous membranes in the left hemithorax undoubtedly was the result of a process of long duration. The involvement of the right pleura—possibly caused by cancerous growth in lymph vessels, which was about two and one-half months old at the time of death—produced only fibrin coating and significant adhesions.

There is some uncertainty as to the final cause of death. There was no direct involvement of any vital organ. The scarcity of symptoms points toward functional heart impairment, the anatomical basis of which might have been the left-sided tumor involvement of the pericardium. Death occurred after the acute stage of the pleurisy and after absorption of the exudate. It is known that not infrequently toxic phenomena appear after absorption of pleural exudate.

The anatomical findings appeared inadequate to explain the patient's death. Whether death was caused by malignant disease alone is known not. It is evident that the tumor behaved for a long time like a benign new growth as evidenced by the absence of symptoms, the unimpaired function of the recurrent and phrenic nerves though surrounded by tumor tissue and the extensive local development of metastases.

SUMMARY

1. Cases of breast cancer with metastasis after radical mastectomy have been tabulated with reference to various details.

2. On statistical evaluation of periods elapsed between operation and recurrence in breast cancer, no evidence of qualitative difference between cases with long and with short latency was found.

3. On surveying various groups of our material it was found that in the average the shorter periods of latencies occur in cases with rapid preoperative growth, presence of metastasis at time of operation and manifestation of the metastasis in the region of the primary growth. No influence of the age and the histological structure (small duct and large duct cancers) was found.

4. On comparison of cases of breast cancer with delayed metastases compiled from the literature no trait common to all these cases was found.

5. One case with the following features suggesting a very low degree of malignancy was extensively described: (1) A period of more than fifteen years elapsed between operation and manifestation of the recurrence. (2) No clinical symptoms appeared until shortly before death in spite of the evidence that the new growth must have been present for a long time. (3) There was no functional impairment of two nerves in spite of their being surrounded by tumor masses. (4) There was huge local development without spread to distant points.

REFERENCES

Barling, G. Quoted by Willis. (1910.)

Bell, F. G. and Darnow, M. M. Quoted by Willis. (1932.)

Cameron, H. C. Quoted by Willis. (1909.)

Ganz, E. Schicksal der im Roentgeninstitut behandelten Mammakarzinompatienten usw. *Strahlentber.*, 57: 413, 1936.

Ginsburg, S. Osteoplastic skeletal metastases from carcinoma of the breast. *Arcb. Surg.*, 11: 219, 1925.

Graham, E. A. Quoted by Willis. (1907.)

Huguenin, R. and Gillet, H. Problèmes posés par les phases évolutives d'un cancer du sein. *Bull. Ass. Franç. p. l'etude du cancer*, 28: 603, 1939.

Leddy, E. T. and Desjardins, A. A. Metastasis of cancer of the breast to the supraclavicular lymph nodes. *Am. J. Cancer*, 25: 611, 1935.

Lewin, H. Quoted by Willis. (1928.)

Neyman, J. and Pearson, E. S. On the use and interpretation of certain test of criteria for purposes of statistical inference I. *Biom.*, 20: 174, 1928.

Pfahler, G. Radiation therapy in carcinoma of the breast. *Am. J. Roentgenol.*, 27: 497, 1932.

Rieffel. Quoted by Williams. (1890.)

Rouviere, H. Anatomy of the Human Lymphatic System. Ann Arbor, Michigan, 1938. Edwards Bros. Inc.

Uffreduzzi, O. Tumori, metastasi neoplastiche e latenza. *Cancro*, 1: 55, 1930.

Williams, W. R. The Natural History of Cancer. New York, 1908. W. Wood & Co.

Willis, R. A. The Spread of Tumours in the Human Body. London, 1934. Churchill.

HYPOXIA—THE HAZARD OF THE OPERATING ROOM*

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WITH increasing frequency there are appearing in the literature articles, case reports and reviews on hypoxia. More and more often are we informed that everywhere in medical practice we have to face the dangers of a lowered oxygen intake, that we must constantly be alert for signs and symptoms referable to an oxygen deficiency.

Those physicians interested in the pursuit of internal medicine have for many years been aware of the dangers of diminished oxygen in certain pathologic conditions. They have for some time been practicing the early and continuous use of oxygen in high concentrations in pneumonia, congestive failure and meteorism as advocated by Barach,[1] Evans[2] and Fine.[3]

Those of us whose specialties confine us to the operating room have recently seen there a rapid maturing of concepts regarding hypoxia and its dangers. This increased concern for hypoxia reflects an increasing regard for physiological fundamentals on the part of the surgeon.

One of the first reports in which a patient on the operating table was thought to have died at the hands of the anesthetist for want of oxygen was seen[4] only in 1916. Caine,[5] Davies[6] and Downs[7] have each reported cases in which patients under nitrous oxide anesthesia expired either in the operating room or shortly after their return to bed. It is curious that in reporting their cases, these authors, as do many others, lament the fact that so few fatalities with nitrous oxide are written up in the literature. This holds true today even more than at the time these authors write, and it is now generally believed that science would be greatly benefited if all fatalities under nitrous oxide anesthesia were made known.

The case of hypoxia has been championed by Waters[8] who has recently called attention to the incorrectness of the word "anoxia." Etymologically "anoxia" means "without oxygen"—an obviously nonexistent condition. The word "anoxia" should, therefore, be replaced with a more correct term—"hypo-oxia" or "hypoxia."

Most of the hypoxia that occurs in the operating room will be the result of nitrous oxide anesthesia. Nitrous oxide is a weak anesthetic agent and will produce nothing but the lightest anesthesia unless metabolic depressant drugs are used as adjuvants. The plane of nitrous oxide anesthesia may be deepened through the diminution of oxygen the patient is permitted to breathe. When the concentration of oxygen in the inspired atmosphere is permitted to drop below 20 per cent, however, the procedure is no longer known as anesthesia. It should properly be termed asphyxia. When more relaxation is demanded than can be obtained by an 80 to 20 per cent nitrous oxide-oxygen mixture, the quantity of nitrous oxide should not be increased at the expense of the oxygen. The anesthetist should change to some more potent agent.

The best exposition of hypoxia that has appeared is Courville's monograph, "Untoward Effects of Nitrous Oxide Anesthesia."[9] Dr. Courville has dealt interestingly and at some length with nitrous oxide and its undesirable effects when inexpertly administered with too little oxygen. His discourse presents everlasting condemnation of the improper use of nitrous oxide and will be a monument in medical literature. He has classified all patients suffering from hypoxia into five groups: (1) Those

* Read before the Brooklyn Surgical Society, April 3, 1941.

dying suddenly on the table; (2) those with delayed exitus; (3) those with prolonged survival periods; (4) those recovering, but with residual cortical damage, and (5) those having transitory mental and emotional changes. He has been so fortunate as to be able to collect detailed case reports on twenty-six patients who had been exposed to hypoxia. The clinical and autopsy findings were seen in each case to follow a rather definite pattern. Courville found that when death was sudden or when it occurred within twenty-four hours the cerebral findings were typical of asphyxia. Insufficient time had elapsed for the development of the more marked signs apparent in those patients with longer survival periods. These evidences of asphyxia were congestion and petechial hemorrhages. It is of interest to note that such changes can be produced at will in experimental animals either by subjecting them to asphyxial mixtures[10] or by artificially stopping the blood supply to the brain. This was done by Weinberger, Gibbon, and Gibbon[11] who ligated the pulmonary artery in cats and found that severe cortical damage occurred if the brain were deprived of oxygen for longer than three minutes and ten seconds.

Varying pathologic pictures will be found in those patients surviving longer than forty hours and who may or may not return to consciousness before death. Here the pathological findings will range from patchy necrosis to widespread degeneration of the cortex and lenticular nuclei. In those instances in which sufficient time has elapsed between the accident and the postmortem examination, there will be seen scarred areas without degeneration.

The symptoms of hypoxia will depend on the degree of oxygen want and its duration. On return to consciousness, the quickly treated patient may present no symptoms at all, or there may be transient mental and emotional changes. When hypoxia has been more severe, there will be prolonged recovery time from the anesthesia and, frequently, convulsions. These are followed by personality changes, hallucinations and progressive mental deterioration. If the hypoxia has been severe, the patient will not regain consciousness. In these cases, deepening coma, hyperthermia and death are to be anticipated, for they are inescapable.

It is by no means true that all the hypoxia seen in the operating room is a result of nitrous oxide anesthesia. Much of it will arise from sources other than the inexpert administration of this agent. It can and frequently does occur with the injudicious use of pain-relieving drugs, nearly all of which reduce the respiratory excursion. Obstruction to a patent airway may result from the sagging jaw, excessive mucus or saliva, vomitus or a relaxed tongue. Deep Trendelenburg position, especially in the obese, sharp angulation of the table in operations on the kidney and use of the gallbladder rest all hinder respiratory movements and aid in the establishment of hypoxia. Persistent laryngospasm will diminish the oxygen available for respiration. None of these factors should be tolerated. Once discovered, it is imperative that the anesthetist take immediate steps to remedy them.

Spinal anesthesia itself may be a potent cause of hypoxia. Seevers and Waters[12] have shown that a "decrease in alveolar as well as arterial and venous blood oxygen occurs" in spinal anesthesia. McClure and his associates[13] have demonstrated a decrease in oxygen saturation of arterial blood of approximately 10 per cent under spinal anesthesia. Such hypoxia is ordinarily attributed to relaxation of the peripheral vascular bed, decreased tonus of the skeletal muscles, diminished respiratory excursion from intercostal paralysis and inactivation of the medullary centers.

The problem of hypoxia in the delivery room is both intricate and interesting. Its consideration is of the utmost importance for here two lives may be ruined by hypoxia. Diminution of oxygen delivered

to the fetus may produce irrevocable damage in its cortex.

The patient's demand for the elimination of pain throughout the first stage of labor must be met. To obtain this analgesia without the production of respiratory depression requires keen judgment and a thorough knowledge of pharmacology and physiology on the part of the anesthetist. During the anesthesia ordinarily accompanying the second stage of labor, an oxygen intake of less than 20 per cent must not be permitted. Frequently it is advisable to use even greater concentrations of oxygen. It is interesting to observe that even in those instances in which cyclopropane was administered with 75 per cent oxygen, the oxygen of the fetal arterial blood ranged from 40 per cent saturation with forceps delivery to 50 per cent in normal deliveries.[14] Both these figures are less than Eastman's[15] for unanesthetized babies. This means that even with a very potent agent like cyclopropane the fetus suffers to some extent from hypoxia. How much more true this is of babies delivered under nitrous oxide anesthesia may be seen from the work of Eastman[16] whose report of five cases showed a fetal arterial oxygen saturation averaging 6.7 per cent. The prevention of hypoxia in the obstetrical patient will require careful and ceaseless observation throughout labor, the thoughtful selection of the proper agent and technic and, finally, complete co-operation between the obstetrician and the anesthetist.

PRACTICAL APPLICATION

From the practical standpoint there are six factors which are of paramount importance in the prevention of hypoxia. Their daily observance will diminish the number of anesthetic accidents and will increase the safety of the surgical patient:

1. The avoidance of the promiscuous use of respiratory depressant drugs. Evidence is ample[13,17,18,19] to show that narcotic drugs (morphine and its derivatives, barbiturates, etc.) tend to decrease the oxidative processes of the cells. This will increase hypoxia. Every patient about to receive a narcotic or sedative must be individualized, and the appropriate dose given. It is inexcusable to order preoperative sedation on a *routine* basis. To order postoperative medication *routinely* is equally indefensible. An individual's response to a respiratory depressant drug can be accurately gauged only by trial and error. The practice of *routinely* ordering repeated doses of narcotics without observing the effects of previous doses is to be thoroughly condemned. The same holds true when avertin is used as a basal anesthetic. Best results are to be obtained when the dose of this drug is reckoned according to the pathology and physiology each patient presents. It should never be ordered on a routine basis.

2. Nitrous oxide should never be given with less than 20 per cent oxygen. If sufficient depth of anesthesia cannot be obtained with this mixture, another agent should be employed. With the numerous agents now at the command of the anesthetist there is no need to subject the patient to hypoxia at any time. In addition to this no anesthesia machine should be used in the modern operating room unless it will deliver accurately calibrated quantities of gases. This is the only way in which the anesthetist can tell the precise percentage of oxygen the patient is receiving.

3. The aim of the competent anesthesist is to disturb the patient's physiology as little as possible. No change in the respiratory rate or volume and no alteration in pulse rate or blood pressure should occur in the well conducted anesthesia. When loss of blood or surgical manipulation occur, these will be reflected in the respiratory or cardiovascular systems. The anesthetist should take appropriate steps to maintain the previous normal levels. Obstruction to respiration should never be tolerated. The patient should breathe as easily when he is anesthetized as when conscious. Any increased respiratory effort on the part of the

patient is an indication for an immediate alteration of the anesthetic procedure.

4. It is particularly important that on the return of the anesthetized patient to bed a competent and well instructed person be delegated to remain constantly at the bedside. The patient *must* be protected against aspiration of mucus and vomitus and from asphyxia from a relaxed tongue.

5. It is recommended that patients exhibiting any of the signs of hypoxia in the operating room receive high oxygen concentrations on return to bed. This is especially true in thyroidectomies. Schnedorf and his co-workers[20] have found that hyperthyroid patients have a diminished arterial blood oxygen saturation. They demonstrated that the oxygen unsaturation was diminished still more when samples of arterial blood were analyzed one hour postoperatively. Avertin-ethylene-oxygen anesthesia was used in their cases. For varying periods after thyroidectomy they placed their patients in a high oxygen atmosphere. It is their contention that there is a marked endocrine imbalance during this operation to which the body must adjust itself. They felt that breathing was easier, the respiratory rate was lower and that there were fewer changes in the pulse and blood pressure when their patients received oxygen therapy after thyroidectomy.

6. As regards spinal anesthesia, it is recommended that its use should not become a routine matter. The science of anesthesiology has progressed to the point where it can offer the surgeon such a wide variety of agents and technics that to employ one agent and one method routinely for all patients is no longer necessary. Patients for spinal anesthesia should be selected from those whom we classify as good risks. Should there be a severe drop in blood pressure, appropriate steps should immediately be undertaken. One or another of the vasoconstrictor drugs should be given and the patient placed in moderate Trendelenburg position so as to prevent cerebral anemia. Oxygen should be given when there is the slightest evidence of hypoxia. No spinal anesthetic should ever be given unless adequate means of providing oxygen are instantly available. This includes apparatus for endotracheal intubation.

Attention to these details should eliminate hypoxia from the operating room. Where they are not carefully observed, the truth of the words of Haldane will all too quickly become apparent. It was this famous physiologist who said[21] hypoxia "not only stops the machine, but wrecks the machinery."

CONCLUSION

The signs and symptoms of hypoxia have been discussed. Various factors concerned in its production in the operating room have been mentioned. Its deleterious effects have been brought forth. It is recognized that the anesthetist plays a major part in the prevention of hypoxia, and recommendations have accordingly been made for its complete elimination from the modern operating room.

REFERENCES

1. Barach, A. L. Widening scope of oxygen therapy in treatment of disease. *Cur. Res. Anal. Anes.*, 17: 71, 1932.
2. Evans, J. H. and Durshordwe, C. J. Indications for oxygen therapy in respiratory diseases. *Cur. Res. Anal. Anes.*, 14: 162, 1935.
3. Fine, J., Sears, J. B. and Banks, B. M. The effect of oxygen inhalation of gaseous distention of the stomach and small intestine. *Am. J. Dig. Dis. & Nutrit.*, 2: 361, 1935.
4. Baldwin, J. F. Nitrous oxide-oxygen the most dangerous anesthetic. *Med. Rec.*, 90: 177, 1916.
5. Caine, A. M. Some unusual complications of nitrous oxide-oxygen anesthesia. *Am. J. Surg.*, 37: 34, 1923.
6. Davies, C. W. Death during nitrous oxide anesthesia for proposed extraction of teeth. *Brit. J. Anes.*, 8: 112, 1931.
7. Downs, T. McK. The carotid sinus as an etiological factor in sudden anesthetic death. *Ann. Surg.*, 99: 974, 1934.
8. Waters, R. M. Anoxia—the anesthetist's point of view. *J. A. M. A.*, 115: 1687, 1940.
9. Courville, C. B. Untoward Effects of Nitrous Oxide Anesthesia. Mountain View, California, 1939. Pacific Press.
10. Thorner, M. W. and Lewy, F. H. The effects of repeated anoxia on the brain. *J. A. M. A.*, 115: 1595, 1940.

11. Weinberger, L. M., Gibbon, M. H. and Gibbon, J. H., Jr. Temporary arrest of the circulation to the central nervous system. *Arch. Neuro. Psychiat.*, 43: 615, 1940.
12. Seevers, M. H. and Waters, R. M. Respiratory and circulatory changes during spinal anesthesia. *J. A. M. A.*, 99: 961, 1932.
13. McClure, R. D., Hartman, F. W., Schnedorf, J. G. and Schelling, V. Anoxia—a source of possible complications in surgical anesthesia. *Ann. Surg.*, 110: 835, 1939.
14. Rovenstine, E. A., Adriani, J. and Studdiford, W. E. Gas changes in maternal and fetal blood during cyclopropane obstetric anesthesia. *Calif. West. Med.*, 53: 44, 1940.
15. Eastman, N. J. Asphyxia neonatorum. *Internat. Clin.*, 2: 274, 1936.
16. Eastman, N. J. Fetal blood studies. v. The role of anesthesia in the production of asphyxia neonatorum. *Am. J. Obst. & Gynec.*, 31: 563, 1936.
17. Quastel, J. H. and Wheatley, A. H. M. Narcosis and oxidation of brain. *Proc. Roy. Soc. London*, 112: 60, 1932.
18. Wortis, S. B. Respiratory metabolism of brain tissue: II. The effects of some drugs on brain oxidation. *Arch. Neuro. Psychiat.*, 33: 1022, 1935.
19. Gross, E. G. and Pierce, I. H. Effect of morphine on the oxygen consumption of brain tissue in the rat. *J. Phar. & Exper. Ther.*, 53: 156, 1935.
20. Schnedorf, J. G., McClure, R. D. and McGraw, A. B. Rationale and use of oxygen in the post-operative treatment of hyperthyroidism. *Surg., Gynec. & Obst.*, 72: 26, 1941.
21. Haldane, J. S. Anoxemia. *Brit. M. J.*, 2: 65, 1919.

Any fracture patient who requires operation should have a program, formulated before the operation is done, and that program should not be disturbed too much, even if complications arise.
From—"Wounds and Fractures"—by H. Winnett Orr (Charles C. Thomas).

MELANOBLASTOMA*

WITH SPECIAL REFERENCE TO METASTATIC DISSEMINATION

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MELANOBLASTOMAS are relatively rare tumors. At The Jewish Hospital, there have been but five in 3,732 autopsies, an incidence of 0.13 per cent. According to Ewing[1] about one-third of all melanoblastomas originate in the choroid, yet the disease occurs in but 0.58 per cent of ophthalmic patients. Davenport[2] reports an incidence of 2 per cent in 1,000 cases of eye disease. The majority of tumors of this type, however, arise in the skin. Melanoblastomas are known to metastasize rather widely, but few cases show as widespread or as unusual metastases as those described below.

CASE REPORTS

CASE 1. M. H., a fifty-five year-old white woman, was admitted to The Jewish Hospital of Brooklyn (Services of Dr. M. G. Wasch and Dr. I. Mensher) on January 10, 1936, with a history of failing vision in her right eye and frontal headaches of a few months' duration. Her past history included a myomectomy for uterine leiomyomas and two curettages for menorrhagia associated with endometrial hyperplasia. Examination of her eyes on admission showed diminution in vision of both eyes. A lobulated tumor was found occupying the temporal sector of the fundus of the right eye with some retinal detachment below. Enucleation of the eye was performed. Microscopically, the cornea was well preserved. The anterior portion of the choroid and the entire ciliary body on the temporal side were replaced by a tumor mass composed of large, spindle-shaped and polygonal cells, varying in size and shape. The cytoplasm contained large amounts of dark brown granules. The stroma was scant and also contained pigment scattered throughout. The retina and choroid were well preserved. The diagnosis was melanoblastoma of the eye. No evidence of metastasis was noted at that time. The patient's right orbit was irradiated postoperatively.

In November, 1937, she developed symptoms of hyperthyroidism which subsided after a subtotal thyroidectomy. Grossly, the specimen consisted of two firm portions of thyroid tissue which measured 7 by 6 by 2 cm. and 6.5 by 5.5 by 2 cm. and together weighed 100 Gm. The external surface was pink and lobulated. The capsule was deficient in some places. The cut surfaces showed lobules of light brown tissue mottled and streaked with red, which were separated by delicate gray strands of fibrous tissue. Microscopically, the preparation showed small and large acini filled with pink staining colloid. The lining cells were columnar with distinct borders, abundant pink-staining cytoplasm, and round or oval vesicular nuclei. In some, the cells were heaped up and papillary infoldings were seen. Interacinar cells were numerous. The connective tissue septa were delicate and contained small lymph follicles. No evidence of malignancy was seen. A diagnosis of hyperplasia of the thyroid gland was made.

In October, 1939, a soft, subcutaneous tumor appeared in her left cheek. This was excised. Grossly, the specimen consisted of portions of friable, gray tissue measuring 2.5 by 2 by 0.9 cm. The external surface was irregular and bore papillary projections. The cut surfaces were gray mottled with black. Microscopically, the preparation consisted of various sizes of polygonal, cylindrical and somewhat spindle-shaped cells. The cytoplasmic borders were distinct; the cytoplasm was fairly abundant and granular. The nuclei were round and vesicular and contained prominent nucleoli. Hyperchromatic nuclei and mitotic figures were numerous. Other tumor cells were large, with abundant granular cytoplasm containing

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crescent-shaped nuclei which were eccentrically placed. The cells were arranged in small nests or formed cords and strands. Some of the

FIG. 1. Case 1. Metastases in left ventricle.

cells contained golden-brown pigment granules. The stroma was scant and delicate. Scattered within the tumor tissue were islands of fairly well preserved striated muscle fibers. In some areas, the cells appeared to be mounted on delicate stalks. The diagnosis was metastatic melanoblastoma.

Thereafter, her course was steadily downhill. In spite of *x*-ray therapy, metastatic nodules appeared in the skin. The liver was considerably enlarged. She suffered from increasing weakness, dyspnea and back pain. Roentgenograms of the chest showed circular deposits in the lungs indicative of metastases.

She was admitted to the hospital for the last time on March 18, 1940, in extremis. Her skin was slightly icteric and many cutaneous metastases were noted. Dullness and diminished breath sounds were noted at both lung bases. The liver was enlarged to the umbilicus. Roentgenograms showed metastases in the lungs, skull and pelvic bones. She died on March 21, 1940. Melanin was found in the urine on various occasions. The clinical diagnosis was melanocarcinoma of the choroid with generalized metastases.

The necropsy was performed one and one-half hours postmortem. Only the pertinent findings will be described:

The body was that of a well developed, fairly well nourished, white woman, 150 cm. long, weighing approximately 70 kilograms. The

FIG. 2. Case 1. Metastasis in leiomyoma in uterus.

skin was pale. There were many discrete firm, and elastic nodules in the subcutaneous tissue which measured up to 4 cm. in diameter. These were located in the left frontal and right occipital regions, in the right chest wall, in the anterior abdominal wall and in the left thigh. There was a transverse scar in the neck immediately above the clavicles which measured 14 cm. in length. A midline suprapubic scar, 12 cm. in length, was also noted. There was slight pretibial edema and varicosities of both lower extremities. The right eye was missing. The sclera of the left eye was icteric. A firm, discrete movable mass in the left breast, approximately 2.5 cm. in diameter, was felt. The neck and chest were symmetrical and the abdomen protuberant.

The serous cavities contained no excess fluid. There were firm, fibrous adhesions in both pleural cavities. The peritoneum, pleurae, pericardium and diaphragm were studded with gray and black nodules, up to 1.5 cm. in diameter, which showed a tendency to coalesce.

In the thyroid gland a few remnants of thyroid tissue were all that remained of the left lobe. The right lobe weighed 5 Gm. and showed nothing unusual.

The heart weighed 272 Gm. Two gray tumor nodules, measuring up to 1.1 cm. in diameter, were seen in the epicardium on the anterior surface of the right ventricle. There was slight thickening of the mitral valve.

Attached to the endocardial surface of the left ventricle below the aortic orifice were two firm, discrete, gray tumor nodules, each measuring 0.5 by 0.2 cm. (Fig. 1.)

Both lungs were the sites of extensive metastases which measured up to 6 cm. in diameter. Some were gray whereas others were deeply pigmented.

The peritoneum and the mesentery of the small and large intestines were studded with coal black, shiny, tumor deposits measuring up to 0.5 cm. in diameter. Larger nodules, which were gray, red and black on section and measured up to 2.5 cm. in diameter, were also noted in a few places.

The liver was firm, measured 33 by 28 by 11 cm. and weighed 6,250 Gm. Only in the caudate lobe was the architecture preserved. Elsewhere it was completely replaced by tumor tissue which appeared speckled and gray, black and brown in color. The tumor was distributed in sharply demarcated areas which differed in pattern and arrangement.

The gallbladder measured 8 by 2.2 cm. Beneath the mucosa and projecting into the lumen were several, irregularly shaped, coal black tumor masses. A single large nodule was seen at the neck of the gallbladder.

The pancreas measured 20.5 by 3 by 2 cm. and weighed 90 Gm. Projecting from the external surface and in the cut surfaces were encapsulated, gray, black and red nodules, measuring up to 1.8 cm. in diameter. The intervening pancreatic tissue showed the usual lobulation.

The right adrenal gland measured 9.5 by 5 by 2.5 cm. and weighed 40 gm. Except for a thin strip of cortex, 0.2 cm. in thickness, the adrenal tissue was completely replaced by tumor. The left adrenal gland measured 5.5 by 4 by 2.5 cm. and weighed 20 Gm. It was similar to the right.

Both kidneys were the seat of metastatic nodules, some of which were large and measured 1.5 cm. in their greatest diameter.

The uterus measured 7 by 5.5 by 3.8 cm. There were two small subserous leiomyomas. Coal black tumor nodules were seen on the peritoneal surface. On opening the uterine cavity, a submucous leiomyoma 3.5 cm. in diameter was seen attached to the wall by a sessile pedicle. The external surface was mottled gray and black in color and glistening. The cut surfaces showed interlacing bundles of gray and white fibers arranged in whorls. Scattered irregularly throughout was deeply pigmented tumor tissue. The Fallopian tubes and ovaries were not remarkable. (Fig. 2.)

The left breast contained a solitary, circumscribed, large tumor mass 2.5 cm. in diameter, which was mottled gray, black and pink in color.

The spleen weighed 245 Gm. and showed no metastases.

The mediastinal, tracheobronchial, portal and peripancreatic lymph-nodes were the seat of tumor deposits.

Small tumor masses were seen in the twelfth thoracic and in the second and third lumbar vertebrae, also in the parietal and frontal bones of the skull. (Fig. 3.)

The dura mater contained flat, deeply pigmented tumor tissue at the site of metastases to the left parietal and right frontal bones. The brain was normal and showed no involvement by tumor tissue.

The right eye was missing. The orbit contained no tumor tissue. The left eye and orbit were normal.

Inasmuch as the histologic structure of the tumors in the various organs was similar, a composite picture is presented. The tumor was composed of solid masses of cylindrical or polyhedral cells, varying in size and shape. The cell outlines were fairly distinct. The cytoplasm was homogeneous and somewhat eosinophilic. The nuclei, for the most part, were round or oval, although some were irregular in shape, many were hyperchromatic. In some the nucleoli were prominent. Occasionally, mitotic figures were seen. Within the cell masses were islands of spindle-shaped cells with indistinct borders, scanty cytoplasm and elongated vesicular nuclei. Dark brown pigment granules were seen intracellularly as well as extracellularly in the delicate connective tissue stroma which permeated the tumor and within endothelial-lined spaces.

Anatomic diagnosis: Melanoblastoma in eye (right); absence of eye (right); metastases in skin, breast (left), lymph-nodes, lungs, pleurae, heart, pericardium, diaphragm, peritoneum, liver, gallbladder, pancreas, adrenal glands, kidneys, uterus (in submucous leiomyoma), bones and dura mater.

Case II. E. V., a thirty-two year-old, white male was admitted to The Jewish Hospital of Brooklyn (service of Dr. L. M. Davidoff) on

July 16, 1940, because of visual disturbances. His past history was irrelevant, but in his family history it was noted that his mother had died from cancer of the urinary bladder at the age of fifty-five years.

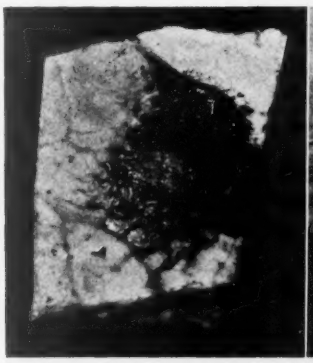

FIG. 3. Case I. Metastasis in left parietal bone.

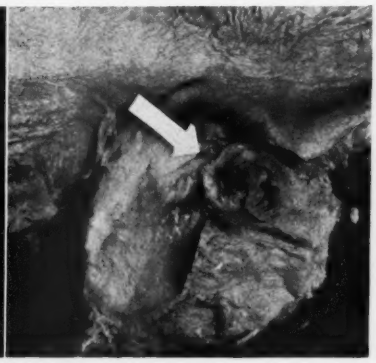

FIG. 4. Case II. Metastasis in prostate gland.

In January, 1939, a pigmented mole was removed from the left side of his cheek at another hospital. It had been present all his life, but because it had increased in size rather rapidly during that month, excision was performed. It was reported as a benign pigmented nevus. The specimen was reviewed in the laboratory of The Jewish Hospital and reported as follows:

Microscopically, the stratum corneum was present and not increased in thickness. The stratum granulosum was prominent and consisted of two layers of cells. The hair follicles were dilated and filled with keratin. The rete pegs were prolonged and pointed. The papillae were swollen, edematous, and where not involved in the hyperplastic process, showed a cellular infiltrate, chiefly perivascular in distribution, consisting of small round cells and plasma cells. In one portion of the preparation, at the dermoepidermal junction, there was a very actively proliferating process. On the epidermal side, there was marked thickening of the prickle cell layer (acanthosis) with several concentrically arranged areas of keratinization (pearls). The basal layer merged imperceptibly with the proliferative process immediately beneath it in the corium. The cells involved in the process were large, polyhedral, with vesicular nuclei, many heavily laden with finely granular brown pigment. The corium in this vicinity was densely packed with large, similarly-shaped cells containing large vesicular nuclei with one or two prominent nucleoli. In some areas, the nuclei were hyperchromatic but the relative size of the cells was fairly uniform. In other areas, the cells showed an alveolar arrangement. Here again, many of the cells contained pigment. In the adjacent connective tissue there were scattered large mononuclear cells, laden with pigment in a much coarser arrangement than in the cells in the neoplastic process. The diagnosis was junction-type nevus. The presence of an inflammatory infiltrate and the variation in staining effinity of the nuclei indicated some degree of malignancy and invasiveness. The patient subsequently completely forgot about the mole. In May, 1940, he noticed for the first time a "body of slight index of refraction" which seemed to move up and down in the lower half of his visual field about twice a second. This occurred several times in succeeding weeks. In the ten days before his admission to the hospital, this was replaced by bright geometrical figures which moved in the upper outer quadrants of his visual field. Early in July, 1940, he suffered from nausea and vomiting. His handwriting became illegible. Gait became subjectively wide-based. He encountered difficulty in recalling the names of people he knew. He had lost eight pounds in weight since the onset of his illness. Ophthalmological examination by a local oculist revealed a left superior quadrant hemianopsia.

The positive physical findings on admission were: a wide-based, halting gait; anisocoria, the left pupil being larger than the right; diplopia in all directions; slight right facial weakness of the central type; and absent right abdominal reflexes. The multiplicity of findings and the absence of localizing signs suggested metastatic tumor deposits in the brain. At the same time, a small subcutaneous nodule in the right loin was noted. Then upon questioning the patient,

the history of removal of the mole from his cheek, was obtained.

Lumbar puncture revealed an initial pressure of 204 mm. of water and a final pressure 110 mm. The Ayala index was 5.39, which was within normal limits. Examination of the spinal fluid was negative as were the chemical studies of the blood, the blood count and urinalyses. The cell count showed nine red blood cells per c.mm. No melanin was found in the urine. Roentgenograms of the skull, pelvis and chest were negative.

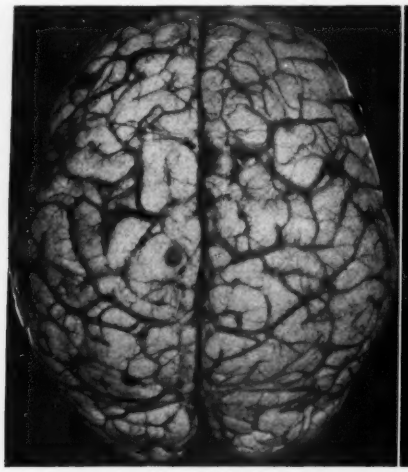

Fig. 5.

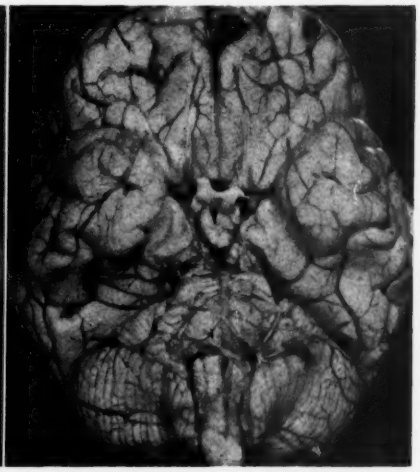

Fig. 6.

Figs. 5 and 6. Case II. Metastases in brain.

A biopsy of the mass in the right loin was performed. Grossly, the specimen consisted of an elliptical portion of skin, which measured 2 by 0.8 cm. The underlying subcutaneous and adipose tissues were attached. Within the latter, soft and elastic in consistency and not attached to the skin, could be felt a nodule. It measured 0.6 by 0.4 by 0.4 cm. On section, the cut surfaces were somewhat translucent and yellow-brown in color. At one pole a few, small, dark brown areas were noted. Microscopically, in the depths of the subcutis, there was a fairly well circumscribed nodule composed of nests of cells separated from one another by delicate strands of fibrous connective tissue. The majority were spherical although they varied somewhat in size and shape. The cells were very large; the cytoplasm was granular and stained pale violet-blue in some places and amber in others. The nuclei were large, spherical or slightly oval, contained abundant chromatin and large, compact, deeply-staining nucleoli. Karyorrhexis and occasional mitotic figures were seen. Where the cells lay loosely in the tissue, they appeared to be more or less spherical in shape, but in the nests they were polygonal or spindle-shaped. Scattered throughout were foci of small round cell infiltration, and in a few places, necrosis was seen. Adjacent to the nodule, in some of the lymphatic spaces, were collections of similar tumor cells. The diagnosis was metastatic melanoblastoma.

While in the hospital, the patient became drowsy and weak. Deep *x*-ray therapy was administered to the brain. He appeared to improve, especially with regard to maintenance of consciousness. He was discharged on September 8, 1940.

Following discharge from the hospital, he vomited considerably, was very weak and complained of severe throbbing headaches. His speech became unintelligible and incontinence of urine appeared. He was readmitted to the hospital on September 18, 1940, in a semi coma. Aphasia was present. The left pupil was fixed. Right facial weakness and ataxia of the hands were noted. A firm, subcutaneous nodule was palpated in the left infraclavicular region. He died on September 27, 1940. The clinical diagnosis was generalized melanoblastomatosis, with particular involvement of the central nervous system.

The necropsy was performed three hours postmortem. Only the pertinent findings will be listed:

The body was that of a well developed, emaciated, white man, 160 cm. long and weighing approximately 50 kilograms. The skin was pale. A scar, 1 cm. in length, was present on the left cheek, and a similar one, 3 cm. in length, in the right loin. There was a sparsity of hair on the scalp. A fairly firm, discrete

tumor nodule, measuring 2 by 1 cm. in diameter, was situated beneath the acromial end of the left clavicle, which on section was composed of tumor tissue. Dorsally, over the sacrum, were three decubitus ulcers which measured up to 3 by 2 cm. The neck, chest, abdomen and extremities were otherwise not remarkable.

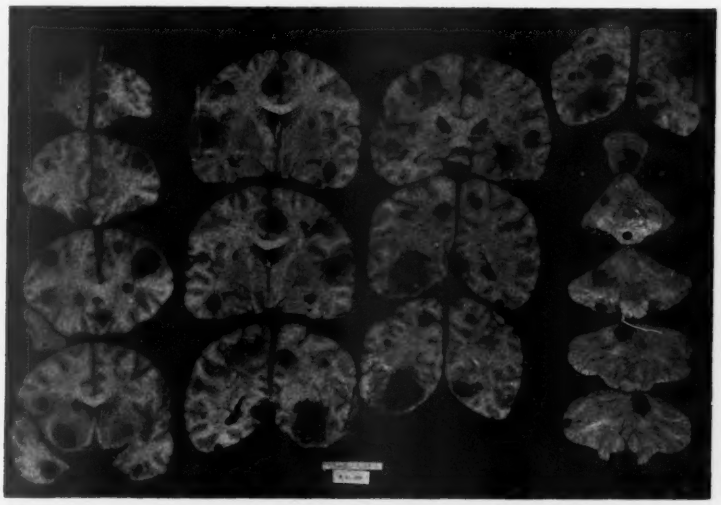

FIG. 7. Case 11. Cut surfaces of brain showing widespread metastases.

The serous cavities contained no excess fluid. Within the gastrocolic ligament were two, soft, discrete tumor nodules, which measured 1.5 cm. in diameter. On section, they were composed of gray, black and brown tissue resembling a marble-like pattern.

The thyroid gland measured 5 by 4.5 by 1.5 cm. and weighed 19 Gm. It showed nothing unusual.

The heart weighed 250 Gm., was of the usual size and shape, and not remarkable.

The right lung weighed 560 Gm. and the left 420 Gm. Scattered in the pleura and extending into the underlying parenchyma were several discrete tumor nodules which measured up to 4.5 by 2.5 by 2.5 cm. On section they showed gray, brown and black tissue in a mottled pattern. Zones of necrosis and patchy hemorrhages were seen in places within the tumor tissue. Edema and emphysema were present bilaterally and a focal pneumonia was noted in the right lung.

A punched-out ulcer, 0.8 cm. in diameter, was located 9 cm. below the pylorus. Its margins were steep, the border round and the base clean. The remainder of the gastrointestinal tract was not remarkable.

The liver measured 23 by 20 by 5.5 cm. and weighed 1,250 gm. It contained no tumor tissue. The gallbladder and cystic duct were congenitally absent. The remainder of the biliary tract presented no other anomalies or abnormalities.

The left adrenal gland measured 7 by 4.5 by 4 cm. and weighed 53 Gm. Almost the entire gland, except for a strip of cortex 0.3 cm. in thickness, was replaced by tumor tissue. There were large areas of necrosis and hemorrhage within the tumor deposits. The right adrenal gland measured 6 by 3 by 1 cm., weighed 9 Gm. and was similar to the left.

The right kidney measured 13 by 7 by 3 cm. and weighed 185 Gm. Beneath the capsule and attached to the surface was a dome-shaped, shiny, black nodule, 0.3 cm. in diameter. A cyst was seen on section. The left kidney measured 12 by 6 by 4 cm. and weighed 165 Gm. A gray-brown sharply circumscribed, partially necrotic tumor nodule, 0.8 cm. in diameter, was seen in the cortex. The urinary bladder was not remarkable. The prostate gland was of the usual size, shape and consistency. On section, in the left lobe, a metastatic gray-brown and black tumor, 0.8 cm. in diameter was noted. (Fig 4.)

The spleen was soft, measured 13 by 8 by 3 cm. and weighed 140 Gm. The external surface was slate gray, smooth and glistening. In the cut surfaces, the Malpighian corpuscles were distinct and the fibrous markings delicate. The pulp scraped slightly.

Within the left trapezius muscle was a coal-black, shiny, sharply demarcated metastatic tumor mass, 1.5 cm. in diameter.

The brain weighed 1,766 Gm. The meninges were delicate. The convolutions were broad and flattened while the sulci were shallow. Scattered throughout all portions of the brain, both in the external and cut surfaces, were round, sharply circumscribed, gray, brown and black tumor masses, which in some places showed small areas of hemorrhage and necrosis. They measured up to 4 cm. in diameter. (Figs. 5, 6 and 7.) Although tumor nodules were seen in the brain stem, they were not seen in the spinal cord. Extradurally, however, at the level of the seventh cervical vertebra was a metastasis which measured 1.5 by 1.2 by 1.0 cm. The pituitary gland was not remarkable.

Inasmuch as the various metastases were histologically similar, a composite description is presented: The tumor was composed of nests and whorls of cells lying in a delicate stroma of loosely arranged strands of fibrous connective tissue. These cells, for the most part, were large, and spindle-shaped, with homogeneous, pink-staining cytoplasm extending peripherally in the form of processes which intertwined with those of adjacent cells. The nuclei were round or oval, vesicular, with one or two prominent nucleoli. Although large, the cells showed some variation in their size and shape and in the staining reaction of their nuclei. Some of the latter were deeply staining and mitotic figures and multinucleated giant cells were fairly numerous. Other cells were polyhedral in shape. Many of these, as well as some of the spindle-shaped variety, contained clumps and granules of golden-brown pigment. In some this was very abundant and was seen also within the nucleoplasm. Similar pigment was seen extracellularly. In scattered areas, the tumor tissue was necrotic. Foci of extravasated blood were also seen. In places tumor cells were seen within endothelial lined spaces.

Anatomic diagnosis: Melanoblastomatosis in skin, lymph-nodes, mesentery, pleurae, lungs, adrenal glands, kidneys, prostate gland, muscle and brain; edema and emphysema of lungs; pneumonia, focal (right); splenitis, infectious; emaciation; congenital absence of gallbladder; ulcer in duodenum; decubitus ulcers.

DISCUSSION

Three organs, the heart, uterus and gallbladder, which are rarely the seats of secondary tumor deposits, were sites of metastasis in the first case.

Concerning the heart, it is believed that metastatic tumors in this organ are very rare. Of a total of 36,980 cases of carcinoma, Nicholls[3] noted that metastases to the heart were present in 109 or an incidence of 0.29 per cent. Scott and Garvin,[4] however, reported the heart invaded by metastatic tumor in 10.9 per cent of 1,082 cases of malignancy. Included in the series were ten malignant melanomas, five of which had metastasized to the heart. Stout[5] reported sixteen tumors of the heart in a series of 1,171 autopsies but made no mention of melanotic tumors. Lymburner[6] found that in a series of 8,550 autopsies the heart contained secondary malignant tumors in forty-two cases; of these six were pigmented. Moragues[7] reviewed the literature and found only twenty-three cases of malignant melanoma with cardiac metastasis. To this group, he presented four additional cases of his own. He believed, however, that cardiac metastasis in cases of malignant melanoma were more frequent than the paucity of reported cases led one to think. At The Jewish Hospital among 435 autopsied cases of malignancies of all types exclusive of blood dyscrasias, metastasis to the heart was noted in seventeen, or an incidence of 3.8 per cent.

According to Kaufman[8] and Frank[9] metastatic carcinomas to the uterus are very rare. None of the general textbooks of pathology or the more specialized books relating to malignant disease give any statistics as to their occurrence. In the series of 435 cases of malignancy at the Jewish Hospital, metastasis to the uterus was observed in nine instances, or an incidence of 2 per cent. In no instance was a metastasis to a uterine leiomyoma present. When present the metastases were due to direct invasion from ovarian carcinomas (four cases) or arose from distant organs via the blood stream.

Secondary tumors in the gallbladder, according to Kaufman[10] are similarly ex-

tremely rare but he recalled having seen two cases of pigmented sarcomas with metastases to this organ. In the authors' series, the gallbladder was the site of secondary tumor deposits from remote primary neoplasms in twenty-two instances, an incidence of 5.1 per cent. Most frequently they occur by direct extension from neighboring carcinomas of the biliary tract, stomach or pancreas, and less often, from primary tumors in distant organs.

Geschickter and Copeland[11] found bone metastases in only 1.07 per cent of cases of malignant melanoma. The vertebrae and cranium were the sites of secondary melanotic tumors in the second case. In the first case, these and other organs were the sites of tumor metastases which probably were hematogenous in origin. In the second case, the unusual features were the presence of metastases to the prostate gland, the central nervous system, particularly the brain stem, and absence of involvement of the liver.

No other case in the authors' series of 435 malignancies showed evidence of invasion of the prostate gland by tumor tissue from a remote primary tumor. All authorities agree as to the rarity of metastatic neoplasms in this organ.

In the first case there were metastases to the dura mater and cranium, and in the second case, to the brain. In both instances, the metastases may have arisen as a result of extension from the lungs, while in the first case, the possibility of extension from the orbit cannot be ignored. A third possibility is spread from some distant focus via the vertebral venous plexus and thence to the cranial cavity. This view has been advanced recently by Batson[12] to explain particularly those cases in which there is absence of lung involvement.

The failure of the liver to be involved by tumor in the presence of a generalized dissemination of the neoplasm is an unusual feature worthy of note, particularly in melanoblastomas, in which the liver is so often the site of maximum involvement. Coincidentally, in this case no melanin appeared in the urine at any time.

The congenital absence of the gallbladder and cystic duct is likewise of interest because of its rarity. Robertson et al.[13] reviewed the literature and found only ninety-six previously reported cases of this condition, to which they added one of their own. At The Jewish Hospital, there have been three cases of congenital absent gallbladder and cystic duct amongst 3,618 necropsies, an incidence of 0.08 per cent.

SUMMARY

Two cases of melanoblastomatosis with widespread and unusual sites of metastasis are described. The frequency and sites of metastases in melanoblastomatosis are discussed. In the case in which no melanin occurred in the urine, there was no involvement of the liver.

REFERENCES

1. Ewing, J. Neoplastic Diseases. 4th ed., p. 961. Philadelphia, 1940. W. B. Saunders Co.
2. Davenport. Some notes on sarcoma of the uveal tract. *Brit. J. Opbth.*, 11: 609, 1927.
3. Nicholls, A. F. Secondary carcinoma implanted on the endocardium of right ventricle. *Canad. M. A. J.*, 17: 798, 1927.
4. Scott, R. W. and Garvin, C. F. Tumors of the heart and pericardium. *Am. Heart J.*, 17: 431, 1939.
5. Stout, A. P. Human Cancer. Philadelphia, 1932. Lea & Febiger.
6. Lymburner, R. M. Tumors of the heart: histopathological and clinical study. *Canad. M. A. J.*, 30: 368, 1934.
7. Moragues, V. Cardiac metastasis from malignant melanoma. *Am. Heart J.*, 18: 579, 1939.
8. Kaufmann. Pathology. Vol. III, p. 1,667. Philadelphia, 1929. P. Blakiston's Son & Co.
9. Frank, R. T. Gynecological and Obstetrical Pathology. P. 230. New York, 1931. D. Appleton and Co.
10. Kaufmann. Pathology.[8] Vol. II, p. 1,008.
11. Geschickter, C. F. and Copeland, M. M. Tumors of bone. *Internat. Surg. Digest.*, 10: 323–343, 1930.
12. Batson, O. V. The function of the vertebral veins and their role in the spread of metastases. *Ann. Surg.*, 112: 138, 1940.
13. Robertson, H. F., Robertson, W. E. and Bower, J. O. Congenital absence of the gallbladder. *J. A. M. A.*, 114: 1514, 1940.

CHOLEDOCHOLITHIASIS*

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IN recent years growing attention has been given to the problem of the common duct stone. The frequency of occurrence of these calculi has increased in direct ratio with the number of common ducts adequately explored at the time of primary operation on the gallbladder.

It has been established that common duct stones may be present in a considerable number of patients in whom there was no clinical suspicion of their existence. Even in the acute inflammatory diseases of the gallbladder, looked upon by many as surgical emergencies, calculi will be found in the common duct in a surprising percentage. Simple palpation of the duct has proved uncertain evidence of the presence of stones. It has become recognized that a certain proportion of the unfavorable results following surgery of the gallbladder for both acute and chronic disease may be attributed to common duct calculi overlooked at the time of the primary operation. More thorough examination of the common duct has been found necessary and the accepted indications for exploration of the duct have been widened. For these reasons, therefore, it is of value to consider briefly the problem of choledocholithiasis. Consideration especially of the incidence and symptoms of common duct stone will establish and justify several indications for exploring the common duct at the time of primary operation on the gallbladder.

ACUTE CHOLECYSTITIS

There is a growing group of radical-minded surgeons who demand that acute cholecystitis be considered as an intra-abdominal surgical emergency requiring operation as soon as possible. Several of the adherents of this school of thought[10,23] support their position by the contention that common duct exploration is an operative hazard that is unnecessary in cases of acute cholecystitis. They argue that the very nature of the pathologic process renders the passage of stones from the gallbladder into the common duct unlikely.

In Table 1 is summarized the operative experience of a group of representative surgeons reporting from various large hospitals and clinics throughout the United States and Canada. It will be seen that, contrary to the contention of the advocates of emergency or early operation for acute cholecystitis, common duct stones are found in approximately one out of every ten patients with acute cholecystitis. In only 30 per cent was the duct explored, yet in one-third of these calculi were recovered. It is quite likely that as more ducts are explored the percentage of positive recovery of stones will be found to increase.

The frequency with which ductal calculi occur in patients with acute cholecystitis offers a serious objection to the routine application of early or emergency operation. It is well known that in some patients the edema and swelling present in the early acute phase of cholecystitis will prevent anything more than a cholecystostomy being done. The same changes will also prevent adequate exploration of the common duct. In some instances, then, secondary operations will be necessary and the mortality of these will have to be added to that of the first operation. In every case the surgeon will have to temper his decision as to the need for emergency

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operation by the knowledge that the common duct should be thoroughly examined.

CHRONIC CHOLECYSTITIS

In Table II are tabulated the reported findings of several surgeons working in the larger hospitals and clinics. Their collective experiences may be accepted as a fairly representative cross-section of the average surgical experience throughout this country.

TABLE I

INCIDENCE OF CHOLEDOCHOLITHIASIS IN ACUTE CHOLECYSTITIS

Author	Place	Year	Total No. of Cases	Ducts Explored		Stones Recovered		
				No.	Per Cent of Cases	No.	Per Cent of Ducts Explored	Per Cent of Cases
Judd and Phillips[1]	Mayo Clinic (1922–1932 Approx.)	1933	508	72	14.1	43	59.7	8.5
Branch and Zollinger[2]	Peter Bent Brigham Hosp. (1914–1934)	1936	229	45	19.6	19	42.2	8.3
Kunath[3]	Univ. of Iowa Hosp. (1925–1935)	1937	90	10	11.1	6	60.0	6.6
Glenn[4]	N. Y. Hosp. (1933–1939)	1939	219	22	10.0	9	40.9	4.1
Graham, R. R.[5]	Toronto Gen. Hosp. (1934–1939)	1939	57	...	.....	6	....	10.5
Koster and Kasman[6]	Crown Heights Hosp. (1928–1937)	1939	341	341	100.0	24	7.0	7.0
Carter, Greene and Twiss.[7]	N. Y. Post-Graduate Hosp. (1920–1937)	1939	574	98	17.0	80	81.6	13.9
Zollinger[8]	Peter Bent Brigham Hosp. (1934–1939)	1940	121	42	34.7	20	47.6	16.5
Fallis and McClure[9]	Henry Ford Hosp.	1940	320	...	.....	20	....	6.2
Pfeiffer and Martin[10]	Lankenau and Abington Hosp. (1935–1940)	1940	70	5	7.1	0	0.0	0.0
Walters, Gray and Priestley[11]	Mayo Clinic (1939)	1940	88	28	31.8	13	46.4	14.7
	Average	....	2,617 (2,240)	663	29.6	240 (214)	32.3	9.2

Only a little over 30 per cent of the ducts were explored at the time of operation on the gallbladder, yet calculi were recovered from almost 40 per cent of those that were explored. Here again, just as in acute cholecystitis, it seems quite likely that as more ducts are explored the percentage of positive recovery of stones will increase.

The reports reviewed indicate that 13 per cent or practically one in eight of all patients with chronic cholecystitis may be expected to harbor one or more stones in the common duct. This becomes even more impressive when it is considered that 6.4 per cent of the cases of common duct stones encountered at the Mayo Clinic[17] and 4 per cent of those encountered at the Lahey Clinic[19] revealed no stones in the gallbladder.

The need to consider the common duct whenever any primary operation is performed for chronic cholecystitis is self-evident from the figures quoted. Even though some 60 per cent of the ducts explored failed to yield any stones, it is necessary to appreciate that many negative explorations must be made in order to accomplish a high percentage of complete removal of ductal stones and a low

percentage of return of symptoms after cholecystectomy.[19]

SYMPTOMS

The classical signs and symptoms traditionally ascribed to common duct stones comprise the triumvirate of jaundice, colic, chills and fever. In Table III a representative series of reports on the frequency of these symptoms are tabulated.

Jaundice. It is not made clear but it appears that what is meant by "jaundice" in the various reports is gross clinical jaundice with evident discoloration of the skin, conjunctivae and mucous membranes. Undoubtedly, a greater percentage of patients with common duct stones would prove to have hyperbilirubinemia were this determined by chemical analysis in every instance. On the other hand, the estimate of the frequency of icterus in several of the reports is based in part on its alleged occurrence in the past. Time and again statements on the part of the patient that bouts of jaundice had occurred previously have proved unreliable and misleading.

The net result of figures so compiled ought to produce a clinically acceptable balance. It is noteworthy, then, that roughly one out of every four patients with choledocholithiasis will at no time display any jaundice. (Table III.)

In patients with acute cholecystitis the occurrence of jaundice need not necessarily be due to a calculus obstructing

TABLE II

INCIDENCE OF CHOLEDOCHOLITHIASIS IN CHRONIC CHOLECYSTITIS

Author	Place	Year	Total No. of Cases	Ducts Explored		Stones Recovered		
				No.	Per Cent of Cases	No.	Per Cent of Ducts Explored	Per Cent of Cases
Judd and Marshall[12]	Mayo Clinic	1931	13,393	.....	.....	1,768	.....	13.2
Crump[13]	Vienna City Hosp. (1927)	1931	325*	325	100.0	78	24.0	24.0
Cheever[14]	Peter Bent Brigham Hosp. (1913–1935)	1935	426†	158	37.9	70	44.3	16.4
Lahey[15]	Lahey Clinic (1910–1938)	1938	2,177	718	32.9	323	44.9	14.8
Carter, Greene, and Twiss[7]	N. Y. Post-Graduate Hosp. (1920–1937)	1939	3,306	260	7.8	213	81.9	6.4
Koster and Kasman[16]	Crown Heights Hosp. (1928–1937)	1939	1,072	1,072	100.0	93	8.6	8.6
Walters, Gray and Priestley[17]	Mayo Clinic (1938)	1939	930†	174	18.7	78	44.8	8.3
Allen[18]	Mass. Gen. Hosp. (Personal Series 1930–1939)	1940	266	159	59.7	98	61.6	36.8
Allen and Wallace[18]	Mass. Gen. Hosp. (1930–1939)	1940	2,088	775	37.1	344	44.4	10.4
Zollinger[8]	Peter Bent Brigham (1935–1939)	1940	442	167	37.8	78	46.6	17.7
Walters, Gray and Priestley[11]	Mayo Clinic (1939)	1940	939	230	24.5	122	53.0	12.9
	Average		25,364 (11,971)	3,713‡	31.9‡	3,265 (1,497)	38.2‡	12.9

* Necropsies.
† Includes some cases of acute cholecystitis.
‡ Excluding necropsy figures of Crump.

the common duct. It is well to remember that in the acute phase, and for a variable period following subsidence, the edema at the neck of the gallbladder or in the cystic duct resulting from the impaction of a calculus in these areas may be great enough to cause compression of the adjacent bile ducts. Jaundice may develop, therefore, as a result of ductal obstruction from inflammatory compression. As long as clinical signs of inflammation persist, one cannot be certain if any accompanying jaundice is due to inflammatory edema alone or to an obstructing common duct calculus.

Colic. The term, "biliary colic," is a much misused one. Contrary to its connotation, typical biliary colic is not a colic. It is rather a constant, sharp, severe pain which mounts in a steady, continuous, crescendo fashion to reach a peak, where it remains until the causative factors are spontaneously corrected or until it is artificially relieved by medication or operation. At no time is it crampy or colicky, although variations in the peak level may occur during a given attack.

The site of the abdominal colic is variable and by no means is it always in the right upper quadrant. Epigastric pain was described in 40 per cent of Cutler and Zollinger's[24] cases of common duct stone. They believe that the incidence of epigastric pain is higher in the presence of a common duct stone than in any other complication of choledocholithiasis. It is their belief based upon experimental observations,[25,26] that initial and persistent epigastric pain strongly suggests a calculus distending the cystic or common duct.

The different observers do not clearly specify the standards used in classifying pain as true colic. They emphasize, however, that the severity of the pain was one of the main criteria. Although a larger percentage of patients described some type

TABLE III

INCIDENCE OF SYMPTOMS IN CHOLEDOCHOLITHIASIS

Author	Place	Year	Number of Cases	Jaundice		Colic		Chills and Fever	
				No.	Per Cent	No.	Per Cent	No.	Per Cent
Judd and Marshall[12]	Mayo Clinic (to 1931)	1931	1,608	1,181*	73.4	1,293†	80.4	597	37.1
Lahey and Swinton[19]	Lahey Clinic (to 1935)	1935	221	129	61.4§	172	77.8	9	4.1
MacDonald[20]	Los Angeles County Gen. Hosp. and The Toronto Gen. Hosp. (1927–1932)	1935	27	25	92.5	12‡	44.4	15‖	55.5
Carter, Greene and Twiss[7]	N. Y. Post-Graduate Hosp. (1920–1937)	1939	326	277	85.0				
Zollinger and Kevorkian[21]	Peter Bent Brigham Hosp.	1939	75	61*	81.0	68	91.0	25	33.3
Trueman[22]	Mayo Clinic (1936 and 1937)	1940	219	133*	60.7	169	77.2	75	34.2
	Average	....	2,476	1,806	73.2	1,714	79.7	721	33.5
	Symptoms Absent in	....	.....	.....	26.8 (1/4)	.....	20.3 (1/5)	....	66.5 (2/3)

* In history or on admission.

† An additional 275 (17.1 per cent) complained of pain in epigastrium, not sufficiently severe to be classed as colic.

‡ An additional 12 (44.4 per cent) complained of dull pain with radiation.

§ Of 210 cases (ten not given).

‖ Of these eight had fever and seven had chills.

of abdominal distress, colic was present in only 80 per cent. (Table III.) One out of every five patients with choledocholithiasis, then, will fail to present a history of typical biliary colic.

Chills and Fever. The relative infrequency of these symptoms is striking. (Table III.) The fact that two out of every three patients with choledocholithiasis fail to show any chills or fever attests to how often calculi may be resident in the extrahepatic ducts without causing any associated cholangitis.

Of the many other symptoms attributed to choledocholithiasis and the associated biliary tract disturbance, two are worthy of special mention:

Previous History Suggestive of Biliary Tract Disease. The vast majority of patients proved to have choledocholithiasis present a history of dyspepsia characterized by fullness, belching, gaseousness, distention and flatulence and recurrent bouts of abdominal pain with or without episodes of jaundice. In the experience of some,[16,24] such a history is a feature of practically every case and in its absence the chance of finding a common duct stone is slight.

Vomiting. It has been observed experimentally[25,26] that while distention of the gallbladder does not cause vomiting, distention of the common duct constantly produces spontaneous vomiting. Cutler and Zollinger[24] make a special point of this and, in their opinion, pronounced involuntary vomiting is suggestive evidence of a stone outside the gallbladder within the cystic or the common duct. Such spontaneous, pronounced involuntary vomiting occurred in approximately 90 per cent of their patients with common duct stone.

Indications for Exploration of the Common Duct. The preceding discussion makes it apparent that stones exist in the main bile channels in a surprisingly large percentage of cases of both acute and chronic cholecystitis. Moreover, the classical signs and symptoms ascribed to such stones are frequently absent and there very often will be no clinical evidence of their presence. In the final analysis, therefore, the presence or absence of stone must be determined by a careful examination of the ducts.

In any compilation of justifiable indications for exploration of the common duct, due attention must be paid to the salient points stressed above. Zollinger[18] has recently offered such a compilation and the indications he lists may be presented without further comment:

CLINICAL HISTORY

1. History or presence of jaundice
2. Cholangitis associated with cholelithiasis
3. Recurrent symptoms after cholecystectomy
4. Frequent attacks of gallstone colic
5. Pronounced involuntary vomiting

FINDINGS AT OPERATION

6. Suspicion of stone by palpation
7. Dilated or thickened common duct
8. Contracted thickened gallbladder
9. Dilated cystic duct
10. Loss of normal appearance of aspirated bile
11. Thickening of head of pancreas
12. Many small stones in gallbladder and cystic duct

There are many surgeons who, while admitting the facts and agreeing to the need for more frequent ductal exploration, warn that widespread application of such exploration will produce an increase in the primary mortality and an increase in the secondary morbidity and mortality from resultant strictures and injuries to the ducts.

Cutler and Zollinger[24] in the six years prior to 1940 had no death following a negative explorationt of he common duct. They are of the opinion, therefore, that the addition of choledochostomy does not increase the general mortality of biliary surgery. Lahey and Swinton[19] are in accord with this opinion. All are agreed, further, that choledochostomy will not add to the operative risk of gallbladder operations provided that the surgeon has had sufficient experience with biliary tract surgery.

The indications for exploring the common duct are so pertinent that any surgeon who undertakes to remove a gallbladder must be capable of performing with equal success any procedure on the biliary ducts.

Even were it true that the addition of choledochostomy to the primary gallbladder operation increased the operative risk, the eventual mortality of secondary operation for stones overlooked would have to be added to the mortality of the primary operation without ductal exploration if a fair comparison is to be made.

Whether or not increased surgical manipulation of the common ducts will result in a multiplication of such complications as stricture, cholangitis, recurrent stone and the like has yet to be fully determined. The results so far in the follow-up periods now available would indicate that there is not much to fear in this respect.[19,16]

CONCLUSIONS

1. The possibility of choledocholithiasis must be considered in every case of gallbladder disease. Approximately one in every ten patients with acute cholecystitis and one in every eight patients with chronic cholecystitis will have a common duct stone or stones.

2. The classical signs and symptoms of choledocholithiasis are frequently absent. In many instances ductal calculi will be found without any clinical evidence to suggest their existence.

3. The indications for exploration of the common duct have been widened. The addition of choledochostomy to the primary gallbladder operation does not add to the risk in the hands of competent surgeons. No one should undertake to operate on the gallbladder who is not capable at the same time of successfully performing operative procedures on the biliary ducts.

REFERENCES

1. JUDD, E. S. and PHILLIPS, J. R. Acute cholecystitic disease. *Ann. Surg.*, 98: 771, 1933.
2. BRANCH, C. D. and ZOLLINGER, R. Acute cholecystitis—conservative treatment. *New England J. Med.*, 214: 1173, 1936.
3. KUNATH, C. A. The treatment of acute cholecystic disease. *Surg., Gynec. & Obst.*, 65: 79, 1937.
4. GLENN, F. Acute cholecystitis. *Surg., Gynec. & Obst.*, 69: 431, 1939.
5. GRAHAM, R. R. Acute cholecystitis. *Am. J. Surg.*, 46: 585, 1939.
6. KOSTER, H. and KASMAN, L. P. The surgical treatment of biliary tract disease (a) acute cholecystitis. *Am. J. Digest. Dis. & Nutrition*, 6: 373, 1939.
7. CARTER, R. F., GREENE, C. H. and TWISS, J. R. Diagnosis and Management of Diseases of the Biliary Tract. Chap. 32. Philadelphia, 1939. Lea and Febiger.
8. ZOLLINGER, R. The surgical treatment of gallbladder disease. *Rev. Gastroenterol.*, 7: 420, 1940.
9. FALLIS, L. S. and MCCLURE, R. D. Acute cholecystitis—a review of 320 cases. *Surg., Gynec. & Obst.*, 70: 1022, 1940.
10. PFEIFFER, D. B. and MARTIN, A. G. Acute Cholecystitis, F. H. Lahey Birthday Volume. Springfield, Ill., 1940. Charles C. Thomas.
11. WALTERS, W., GRAY, H. K. and PRIESTLEY, J. T. Personal communication.
12. JUDD, E. S. and MARSHALL, J. M. Gall stones in the common bile duct. *Arch. Surg.*, 23: 175, 1931.
13. CRUMP, C. The incidence of gall stones and gallbladder disease. *Surg., Gynec. & Obst.*, 53: 447, 1931.
14. CHEEVER, D. Methods and results in the surgical treatment of diseases of the biliary passages. *New England J. Med.*, 213: 463, 1935.
15. LAHEY, F. H. Common and hepatic duct stones. *Am. J. Surg.*, 40: 209, 1938.
16. KOSTER, H. and KASMAN, L. P. The surgical treatment of biliary tract disease (b) chronic lesions. *Am. J. Digest. Dis. & Nutrition*, 6: 376, 1939.
17. WALTERS, W., GRAY, H. K. and PRIESTLEY, J. T. Report of the surgery of the gallbladder, liver and pancreas for 1937 and 1938. *Proc. Staff Meet., Mayo Clin.*, 14: 773, 1939.
18. ALLEN, A. W. and WALLACE, R. H. The surgical management of stone in the common bile duct. *Ann. Surg.*, 111: 838, 1940.
19. LAHEY, F. H. and SWINTON, J. Stones in the common and hepatic bile ducts. *New England J. Med.*, 213: 1275, 1935.
20. MACDONALD, I. G. The histology of the biliary ducts and its correlation with the symptomatology of common duct stone. *Surg., Gynec. & Obst.*, 60: 775, 1935.
21. ZOLLINGER, R. and KEVORKIAN, A. Y. Surgical aspects of obstructive jaundice. *New England J. Med.*, 221: 486, 1939.
22. TRUEMAN, K. R. Symptoms of common duct stone: review of 219 cases. *Proc. Staff Meet., Mayo Clin.*, 15: 283, 1940.
23. LIPSHUTZ, B. Acute cholecystitis. *Ann. Surg.*, 101: 902, 1935.
24. CUTLER, E. C. and ZOLLINGER, R. Surgery of the gallbladder and extrahepatic bile ducts. *Am. J. Surg.*, 47: 185, 1940.
25. ZOLLINGER, R. Observations following distention of the gallbladder and common duct in man. *Proc. Soc. Exper. Biol. & Med.*, 30: 1260, 1933.
26. ZOLLINGER, R. Significance of pain and vomiting in cholelithiasis. *J. A. M. A.*, 105: 1647, 1935.

ONE HUNDRED ONE CASES OF INFECTIONS OF THE FACE AND NECK FOLLOWING ORAL PATHOLOGY*

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IN proportion to the number of patients treated each day by the numerous dentists in this city, investigation has shown that complications, resulting from dental pathology are few. We have often seen a friend with a swollen face on his way to the dentist and have sympathized with him, not fully realizing the potential dangers of this swelling. We expect him to get well and in most instances he does. However, in certain cases the infection spreads, and it is about these patients that this paper is concerned.

From July 1, 1939, to July 1, 1940, there were admitted to the Plastic Service of Kings County Hospital, 101 cases of infections of the face and neck, whose etiology was directly attributed to dental pathology. This number does not include fractures of the facial bones nor complications.

The following statistics have been reported. Beck,[1] in reporting twenty-four cases of neck infections, found three due to dental pathology: two cases following single extraction, and one case following multiple extractions because of extensive alveolar disease. Boemer[2] found that one-third of all his adult neck infections were due to infections of the lower molar teeth. Alden,[3] in 1936, presented twenty-nine cases of neck infections resulting from dental pathological conditions. Thus you can see the significance of this subject and we cannot overstress the importance of the pathogenesis nor the treatment. In the analysis of the age, we find the extraordinary fact that the greatest number of complications were found in persons between the ages of eleven and thirty years. Since these persons are of the school age and early industrial age, we certainly can foresee the work that prophylactic care can do.

TABLE I

Age	No. of Cases
2 to 5	1
6 to 10	15
11 to 20	27
21 to 30	29
31 to 40	9
41 to 50	10
51 to 60	8
61 to 70	1
71 to 80	1
Total	101

With the spread of the pathological condition from the localized area, there was a notable increase of symptoms. These were characterized by pain, swelling, not only of the local area but of the contiguous regions, fever, malaise and often trismus. Frequently, the spread of infection occurred within the first week.

TABLE II

Day	No. of Cases	Day	No. of Cases
1st	0	7th	8
2nd	15	8th	1
3rd	11	9th	12
4th	12	10th	5
5th	12	11th	5
6th	9	12th	3
		13th	8

A number of cases had no surgical interference, while the most serious ones followed extractions. The teeth listed as to the number of times involved were:

Upper teeth	8	7	6	5	4	3	2	1	—	1	2	3	4	5	6	7	8
	↓	↓	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓	↓	↓
Times involved	4	1	7	1	4	1	4	10	—	12	2	4	2	0	3	2	1

* From the Department of Plastic Surgery, Kings County Hospital, Dr. Walter A. Coakley, Director.

Lower teeth.....	8	7	6	5	4	3	2	1	—	1	2	3	4	5	6	7	8
	↓	↓	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓	↓	↓
Times involved...	8	8	6	1	1	0	0	0	—	1	1	1	0	3	11	10	7

The upper central incisors are often involved but usually the infection is localized. Thus it can be seen that the lower molars were involved most frequently, and when one considers how closely they are related to the neck and its structures, a study of the anatomy of the neck is imperative before treatment of dental infection can be managed.

Mosher,[4] in his epic talk in 1929, brought to us the importance of the muscles, fascia, vessels and glands of the neck. In a comprehensive manner his description served to stimulate others. His words, "Pus in the neck calls for the surgeon's best judgment, for his best skill, and often for all his courage. Pus in the neck kills by edema of the larynx, or by the burrowing pus, bursting its bounds, and flooding the larynx and trachea," are as pertinent today as they were in 1929.

How does this pus reach the neck from the teeth, and where does it go, once it gets there? Alden[3] believes that as the tooth is infected and the process spreads there is a suppurative periostitis at the side of the local lesion, spreading downward or backward alongside the mandible and then breaking through the deeper structures. A second cause is the infection starting as a soft tissue cellulitis and carried from there to the contiguous structures, sometimes, even to distant structures by venous circulation or lymph channels. Dorrence[5] states that often suppurative material from a dental root will follow the mandibular canal and find exit at the inferior dental foramen and then pass down the mylohyoid groove between the periosteum and the sublingual tissues. Once the pus finds itself in the natural spaces of the neck, it will collect.

What is meant by the natural spaces of the neck? Barnhill[6] very aptly uses this explanation. Disease of either the cervical muscles or of the cervical fascia is extremely rare, and hence, each owes its surgical importance to other reasons. The muscles serve as land marks, while the fascia is important because:

1. It provides a strong wrapping material, which safely and securely encloses the whole of the neck in one package, but also each individual structure or group of structures in its own separate housing.

2. The intervals between the layers of fascia, which contain more or less connective tissue furnish ideal channels through which nerves, lymphatics and blood vessels run.

3. These same connective tissue-filled intervals also provide pathways along which pus may readily burrow. The degree of ease with which pus finds its way about, in the neck depends upon the amount of connective tissue present.

4. There are several areas in the neck where a large amount of connective tissue is present and the knowledge of these places, enables the surgeon to find the sites of disease without entering danger zones. The connective tissue is so abundant in these places that the finger can easily get into them. These places are; (a) in the floor of the mouth; (b) along the carotid sheath; (c) prevertebral or retropharyngeal space; (d) lateral pharyngeal or pharyngomaxillary space, and (e) at the tip of the mastoid (Bezold's abscess).

In order to understand the mechanism of neck infections and the treatment, we must consider the anatomy of the cervical fascia. The superficial layer of the deep cervical fascia covers and encloses all the structures of the neck from the skull above to the clavicle below. Let us start in the midline posteriorly where the fascia is attached to the spinous processes. It runs anteriorly, and splits to enclose the trapezius muscles, unites again, and then splits to enclose the sternocleidomastoid muscle laterally, reunites and anteriorly splits again to envelop the pretracheal or subhyoid muscles. The fascia then fuses in the midline. Viewing this sheath in a perpendicular line, below it is attached to the acromium, clavicle and the manubrium

sterni, forming the space of Burns' behind the latter. Going up, it attaches to the hyoid bone. Leaving the body of the hyoid bone, it rises to split and enclose the submaxillary gland, and then attaches itself to the mandible, the inner layer along the mylohyoid ridge and the outer layer to the outer edge of the horizontal ramus or body. This outer layer then runs up and splits to form an envelop for the parotid, in the same manner that the submaxillary gland was enveloped. The outer layer of the parotid fascia now goes up to attach itself to the inferior border of the zygoma. The deep layer of the parotid fascia is thin, while the outer layer is very thick. Mosher[4] states that there are defects in the deep parotid fascia, while Barnhill[6] states that these defects are difficult to demonstrate. This is of great surgical importance, since it means that infections of the parotid will not break outward easily, but will point inward, which, as you will see, means going into the lateral pharyngeal space. From the zygoma, the fascia will rise to attach itself to the upper nuchal line of the occipital bone and the mastoid process. It covers the temporal muscle and adheres to the temporal ridge.

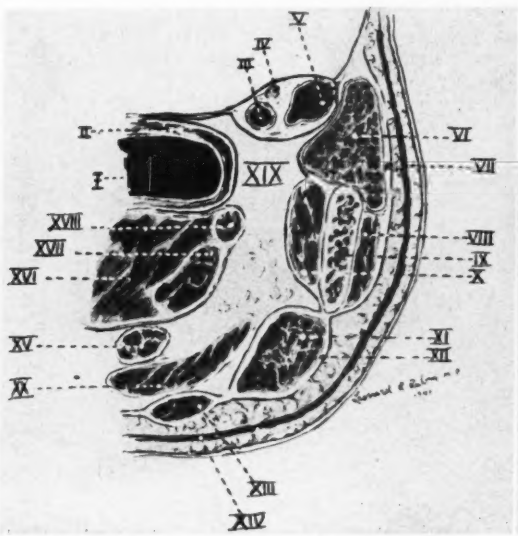

Fig. 1. Oblique anteroposterior view of the face and neck, showing relationships of parapharyngeal space: I, pharynx; II, superior constrictor; III, common carotid; IV, vagus; V, internal jugular vein; VI, parotid gland; VII, fascia external to parotid gland; VIII, masseter muscle; IX, mandible; X, internal pterygoid muscle; XI, submaxillary gland; XII, fascia of submaxillary gland; XIII, anterior belly of digastric muscle; XIV, platysma; XV, geniohyoid muscle; XVI, genioglossus muscle; XVII, hyoglossus muscle; XVIII, stylopharyngeus muscle; XIX, lateral pharyngeal space; XX, mylohyoid muscle.

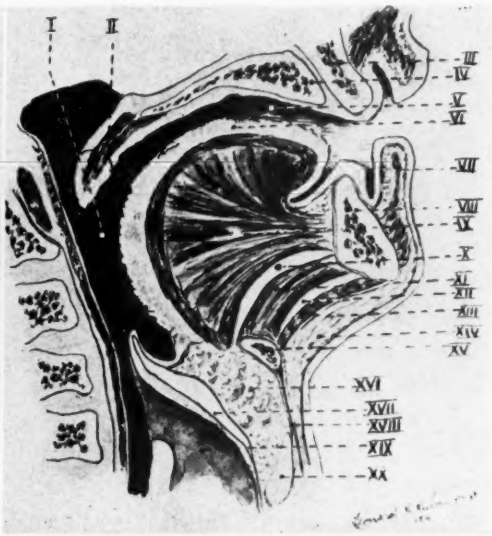

Fig. 2. Vertical midline section through face and neck, showing the spaces in the floor of the mouth: I, pharynx; II, soft palate; III, alveolar process of maxilla; IV, hard palate; V, mouth; VI, mucous membrane of tongue; VII, lower lip; VIII, mandible; IX, genioglossus muscle; X, space between genioglossus and geniohyoid muscles; XI, geniohyoid muscle; XII, space between geniohyoid and mylohyoid muscles; XIII, mylohyoid muscle; XIV, superficial fascia; XV, hyoid bone; XVI, fat; XVII, epiglottis; XVIII, hyothyroid ligament; XIX, vestibule of larynx; XX, thyroid cartilage.

Having followed the superficial layer of the deep fascia, we will now try to show how deep offshoots of the superficial fascia will make up the fascial planes we have talked about.

First, we must make the statement that the hyoid bone is the most important land mark in the neck. It serves to divide the neck into an upper and lower compartment. The cervical fascia has strong attachments to it and together with the density of the membrane forms a strong

barrier between the floor of the mouth and the infrahyoid region of the neck.

The deep offshoots of the superficial layer of the deep fascia serve to wrap different groups of structures. As the superficial layer splits around the sternocleidomastoid muscle, the deep layer gives off fascia which wraps itself around the great vessels of the neck, thus forming the carotid sheath, or, as Mosher describes it, the Lincoln Highway of the neck. It contains the carotid artery, the internal jugular vein and the vagus nerve. It serves to go up into the skull and down the neck to the chest and forms the main pathway along which pus can travel. Leaving the carotid sheath, the fascia unites again and going deep, forms the prevertebral fascia, which lies in front of the longus colli muscles and the bodies of the cervical vertebrae. Just anterior to the deep offshoot of the carotid sheath fascia, a layer leaves the deep surface of the sternocleidomastoid muscle and runs anterior to the trachea and thyroid, and, being called the pretracheal fascia, serves, by meeting prolongations of the prevertebral fascia, to envelop the visceral structures of the neck, as the esophagus, the thyroid and the trachea, forming the visceral compartment. The pretracheal fascia also goes forward to envelop the omohyoid, sternothyroid and sternohyoid muscles and then meets in the midline.

The fascia thus makes such compartments in the neck that Barlow[7] has named them as four units: (1) Vertebral, (2) visceral, (3) great vessels and (4) vaginal (sternocleidomastoid) (Trapezius).

Between the visceral and the vertebral, there is a rectangular space which runs from the thorax to the skull. It is constricted a bit at the level of the hyoid but it reaches the arch of the aorta.

You will recall that the deep surface of the parotid sheath is thin. From the deep surface of the parotid there is a prolongation that goes deep to attach itself to the styloid and mastoid processes. It is thickened into a ligament running from the styloid process to the inner surface of the mandible as far down as the angle. This is the stylomandibular fascia which after

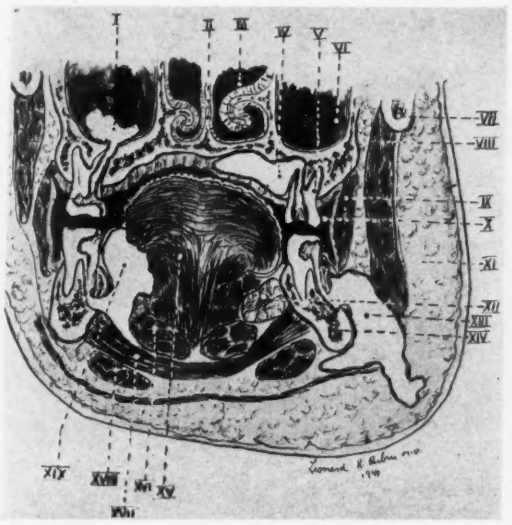

Fig. 3. Diagram showing direction of spread of pus from diseased molars; vertical section through molars: I, pus from tooth ruptured into maxillary sinus; II, nasal septum; III, nasal cavity; IV, pus from tooth ruptured between hard palate and mucous membrane; V, molar tooth; VI, maxillary sinus; VII, zygoma; VIII, masseter muscle; IX, buccinator muscle; X, oral cavity; XI, fat pad of cheek; XII, sublingual gland; XIII, pus ruptured externally into cheek seeping towards mylohyoid; XIV, mandible; XV, genioglossus muscle; XVI, geniohyoid muscle; XVII, mylohyoid muscle; XVIII, anterior belly of digastric muscle; XIX, pus ruptured beneath tongue into sublingual space.

attachment to the mandible, moves out to join the superficial layer of the cervical fascia. In this process, it separates the parotid from the submaxillary gland. This is of great importance, since it will serve as the posterior wall of the lateral pharyngeal space.

You may think that we have digressed from our original discussion of tooth infection but it was necessary to explain the fascial ramifications because they form the spaces into which the pus from the teeth invade.

The submaxillary space must now be considered. It is formed by the splitting of the superficial layer of the cervical fascia and is complete, enclosing the submaxillary gland (which has its own sheath and rarely is infected itself), the facial

artery which enters the gland behind, and then becomes superficial. The gland, turning around the posterior border of the

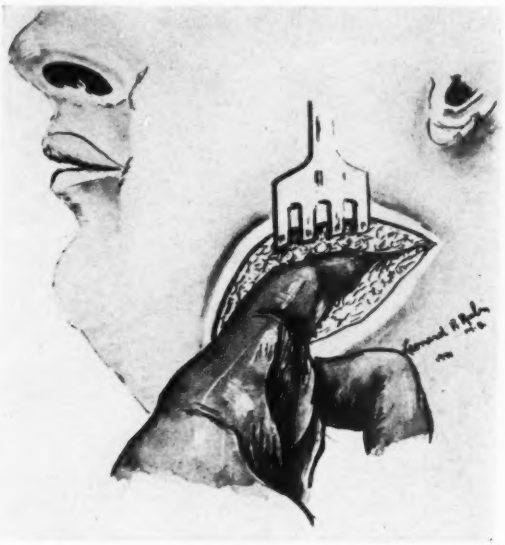

FIG. 4. Finger inserted through incision toward parapharyngeal space.

mylohyoid muscle juts in between the internal pterygoid and the lateral pharyngeal space making a direct root from the submaxillary space to the lateral pharyngeal space. Infection of the submaxillary space is most common. We believe that this space is infected first and then the pus spreads to other spaces, the most common being the lateral pharyngeal space. Barlow,[7] using the dye injection method, somewhat like Kanavel, showed that injection of the submaxillary space drove the fluid: (1) behind the posterior border of the stylohyoid muscle to the floor of the mouth where it produced a bulge; (2) back between the internal pterygoid and lateral pharyngeal wall or the so-called lateral pharyngeal space, and (3) down and inside of the condensation of the facial vein and the lingual vein from there to the carotid sheath.

A survey must now be made of a most important space known by anyone of the following names, as the lateral pharyngeal space, the parapharyngeal space or the pharyngomaxillary space. Mosher[4] called attention to it in 1929 and attributed most of the etiology to pathological conditions in the pharynx. We find that it is very commonly infected by suppuration coming from the submaxillary

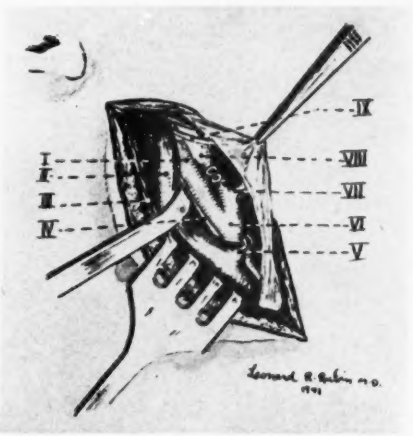

FIG. 5. Tying off the external carotid artery above the superior thyroid artery.

space, secondarily from infections of the lower molars. Alden[3] states that the second and third molars often infect the parapharyngeal space. Ford[8] reports that the lateral pharyngeal space is involved in half of all deep neck infections. Beck[1] reports the tonsils as the cause in 58 per cent of cases. Mosher[4] describes this space as a cone with the base around the jugular foramen of the skull and the apex at the greater corner of the hyoid. The carotid sheath emerges from the apex and for practical purposes continues the cone through the neck and into the chest. It is bounded outside (laterally) by the ramus of the mandible, the parotid, the internal pterygoid muscle and the fascia that covers it. The inner wall is covered by cervical fascia lining the superior constrictor. The anterior wall is limited by the pterygomandibular raphe which is joined by the fascia reflected from the pterygoid muscles and the superior constrictor. Posteriorly, the wall is made up by the styloid process, the stylopharyngeal and the stylohyoid muscles. The stylomandibular fascia and the carotid sheath are behind these; the roof and floor of the cavity are continuous with the carotid sheath. There is much loose areolar tissue around the

sheath, and an abscess breaking into the carotid sheath from the lateral pharyngeal space will travel up and down the neck. the fascial sheath of the trapezius and also along the course of the intertransverse branches of the vertebral vessels. (2)

FIG. 6. Case of submaxillary and parapharyngeal space infection of molar tooth origin.

FIG. 7. Same as Figure 6 showing large rubber tube sutured in parapharyngeal space.

In surgery into this space, which can be entered easily with a finger, the styloid process is felt on the posterior wall. It must be remembered that ordinarily the space is filled with connective tissue and fat, and is actually in existence only when it is filled with pus. Barlow[7] in his dissections states that the styloid muscle, the stylopharyngeal muscle, and the tough stylopharyngeal aponeurosis, spreading medially and forward from the styloid process and the stylopharyngeal muscle to the lateral pharyngeal wall, act as strong barriers between the carotid sheath and the lateral pharyngeal space. To substantiate this, he injected the space with dyes and was not able to see any spread downward to the carotid sheath.

Barlow,[7] continuing his injection technic on other spaces in the neck, found: (1) *The retrovisceral scace*—there was a lateral limit by the fascia covering the trapezius. Below, it traveled to the third thoracic vertebra. Above, it traveled to the skull. Under pressure, it broke laterally into

The parotid space—spreads upward to the temporal space and with pressure spreads to the lateral pharyngeal space and along the fascial and superficial temporal vein. (3) *Subvaginal space*—the space filled rapidly and most completely beneath the sternocleidomastoid muscle and the posterior triangle. The injected fluid did not pass anteriorly into the anterior triangle or under the trapezius nor did it enter any other space. It did outline a space in front of the muscles of the visceral unit that reached from the manubrium to the hyoid. It also filled a space behind the muscles and extended among the viscera, especially the trachea. It did not cross the midline.

Our next subject is the floor of the mouth. An excellent dissection both pathologically and anatomically has been done by Collier and Ygesias.[9] These investigators found that two spaces made up this dangerous area. Under the tongue is a space which lies between it and the geniohyoid muscle. This is the space involved in the so-called Ludwig's angina. Going outward another space exists between

the geniohyoid and the mylohyoid muscle. Actually, there is a space between the skin and the platysma which is involved in

Fig. 8. Parapharyngeal space infection following molar tooth pathology.

erysipelas and superficial abscesses. Also, there is a potential space between the platysma and the mylohyoid muscle. A fifth space, according to Barnhill[6] lies beneath the mucosa and around the sublingual gland.

The space between the geniohyoid and the genioglossus runs from the posterior border of the mandible down to the hyoid bone. If one side is involved, the other side will be too, since there is no partition between them. Barnhill,[6] in his description of the sublingual space says, "Like the other spaces, it is only potential and contains connective tissue. The roof is formed by the mucosa of the mouth, externally, the wall of the pocket is formed by the fascia which envelops the submaxillary gland, and centrally, will be the sublingual gland. The posterior boundary is the fascia, which separates the glands and envelops the muscles of the floor of the mouth. In the anterior part of the space, the lingual nerve will be seen to enter the tongue, also, there will be the ducts of the submaxillary and the sublingual glands, and a little lower and further back the hypoglossal nerve. This space provides lodgement for infection and separation in the floor of the mouth, commonly known as Ludwig's Angina." He also states that a heavy fascial wall separates the lateral sublingual space from the lateral pharyngeal space. An abscess in the sublingual space will break into the lateral pharyngeal space only if under pressure and neglected. Also, the abscess can readily spread to the opposite side because all muscles and fascia which form the floor of the mouth are bound together only by an abundance of loose connective tissue, which extends from one side to the other.

We have gone into an extensive description of the anatomy of the cervical fascia, because, only in complete understanding of these parts will we be able to perform proper surgical remedies. The spaces mentioned above are most likely where pus is found. It must be remembered, that the pus will follow these spaces and that strong fascial sheaths will delimit the pus, but in neglected cases, erosion of these fascial planes will allow pus to pass from one space to another.

DIAGNOSIS

Localized abscess is a common dental pathological condition. It is only when it begins to spread that we are concerned. Most often, there is a history of toothache, followed by swelling of the region. When spread occurs to any of the spaces, there is associated malaise and fever. The most common spread from the molars is to the submaxillary space which is characterized by marked swelling, anterior to the angle of the jaw and spreading down the neck. Also, there is a moderate temperature and a slight trismus. In most cases when there is a further spread, trismus becomes marked and the temperature will rise to 103°F. or higher. At this point, we can be sure the infection has spread between the submaxillary and the internal pterygoid muscle and has entered the lateral pharyngeal space. In our series we had twenty such cases. If the lateral pharyngeal

space becomes filled with pus, we may have a Horner's syndrome, characterized by dilation of the pupil on that side, due to irritation of the sympathetic nerve. The temperature may rise to 105°F. and the patient may become very toxic. Septic temperature rise makes one suspect infected thrombus of the internal jugular vein, and this can be verified by a blood culture. Many authors mention the bulging of the tonsillar region in lateral pharyngeal infection. We can say only that there is such trismus present that we have been unable to visualize this area in order to confirm the bulging.

We have seen five cases that we consider Ludwig's. In all, the pathology was present originally in the molars of the mandible with a submaxillary space infection. Suddenly, there were chills, rise in temperature, swelling of the floor of the mouth and submental region, breathing became difficult and the patient became very toxic. The tongue appeared to be markedly swollen. Rarely was fluctuation felt under the chin, instead, it felt hard and woody, giving it the name woody phlegmon.

Should the infection start in the parotid space, the symptoms would be that of fever, chills, marked swelling over the parotid region, no fluctuation (because of the heavy parotid sheath externally) and soon thereafter, trismus may appear. The trismus tells of the involvement of the lateral pharyngeal space. In one of our cases, there was a spread from the parotid space along the fascia to the temporal space. This was characterized by swelling of the temporal region, marked edema of the eyelids, but again, no sign of fluctuation. If the suppuration breaks superficially, it will appear around the outer canthus.

FIG. 9. An early Ludwig's angina.

FIG. 10. Parotid space infection of dental origin.

TREATMENT

Let us quote Mosher[4] who said, "Pus in the neck calls for the surgeons' best skill and often for all of his courage. Pus in the neck kills by edema of the larynx, or by burrowing pus bursting its bounds and flooding the larynx and trachea. Cosmetic surgery and life and death surgery do not mix. No small incisions should be made. The deeper the surgeon works, the smaller the operative field."

The patient, upon admission to the hospital is very sick. If active treatment is started, the prognosis is good. In our 101

Fig. 11. Convalescent parapharyngeal space infection. Preliminary tracheotomy had been done.

cases, there were two deaths: one patient had a well developed bronchopneumonia when admitted; the other patient who had been neglected for several days, did not respond to surgery. It must be remembered that the average submaxillary space infection localizes and is often fluctuant. If no fluctuation is present and the temperature remains high, it is time for immediate surgery, since the spread has been inward to the parapharyngeal space. Sulfanilamide is a great adjunct and is given routinely in all severe infections. Hot compresses are placed on the infected side, provided surgery is not immediately indicated. Hot saline mouth gargles are indicated every half hour. With little toxicity, we can wait for fluctuation. When fluctuation occurs, a local incision and drainage into the submaxillary space is performed. This is done by making a skin incision below the inferior margin of the mandible from the angle of the mandible half way anteriorly toward the symphysis. A curved clamp is then inserted to the periosteum of the infected tooth area and the pus is allowed to escape. A long tube is inserted and then connected with an irrigating apparatus for continuous drainage and irrigation. If we suspect infection of the lateral pharyngeal space, the same incision is made. However, it is imperative that the cervical fascia be incised below the attachment to the mandible. If the fascia is not incised, the finger will not enter the pharyngeal space. In one case, there was such an extensive swelling of the side of the face, that the exact measurement from the skin edge to the cervical fascia was three inches. The point of entry to the parapharyngeal space is between the submaxillary gland and the downward prolongation of the parotid gland. The index finger is the best guide when properly inserted and the mandible can be felt externally to the finger. We have not investigated the lateral pharyngeal space through the tonsillar fossa, always believing that the course of the pathological condition was through the submaxillary area. When the carotid sheath is involved, we use Mosher's T-incision, following along the inferior margin of the mandible and then along the anterior border of the sternocleidomastoid muscle.

In some cases, due to the destructive processes of suppuration in the neck spaces, uncontrolled hemorrhage occurs and prompt ligation of the external carotid is essential. In tying the external carotid for bleeding, the incision is made along the anterior border of the sternocleidomastoid muscle for a distance of three inches. The muscle is reflected posteriorly and the tip of the great horn of the hyoid is felt. Posterior to the tip of the great horn of the hyoid will be found the external carotid artery. Where infection is present in the internal jugular vein the same incision is made. The facial and lingual veins are present about the tip of the hyoid, the facial below and the lingual above. In exposing the internal jugular vein, one must be careful not to injure the superior thyroid artery. The tip of the great horn is the most important landmark in the

neck. It can always be seen and palpated. Of the sixteen important structures of the neck, only the glossopharyngeal nerve, the recurrent laryngeal nerve and the phrenic nerve are not in relation to the great horn of the hyoid bone.

Whenever there is marked difficulty in breathing, the problem of early tracheotomy presents itself. We definitely believe in early tracheotomy in such cases before any surgery is attempted on the neck infection. Previously, we have had some dramatic experiences in cases in which the tracheotomy was not done before the surgical incision and drainage. When the tracheotomy is done early, the surgeon can believe that his patient is safe from a respiratory standpoint and that the drainage can be performed whenever necessary. Occasionally, we hear surgeons state that they always have a tracheotomy set, steriled and handy at the bedside. To us, this appears as wishful thinking. When the respiratory accident happens, every second counts and the resulting drama makes a simple operative procedure appear mediocre.

When Ludwig's is present, we do not wait for fluctuation. Gorden New[11] stresses conservation in woody phlegmon where, he says, pus is never encountered and should never be incised even though it takes weeks to subside. He believes that the barriers set up by nature are of even greater importance than the fascial planes. We differ sharply with him here. From our anatomical studies we have concluded that watchful waiting will leave us a dead patient. We have never incised a Ludwig's through the mouth, although Barnhill mentions it to be one method of approach. A local anesthetic is used on Ludwig's surgery as in other space infections. We usually make our incision run from one submaxillary space to the other submaxillary space through the submental region. The spaces are carefully explored by blunt dissection. We suture tubes into the spaces and later connect them to irrigation cans of hot saline. Previously, we have made midline incisions, but we now agree with R. Colp[12] that there is no point in doing this.

Fig. 12. Convalescent Ludwig's angina of dental origin. Preliminary tracheotomy was necessary.

When the parotid is infected, we make one or more incisions anterior to the tragus. With a clamp we break into the parotid space, spreading our clamp carefully so as to avoid injury to the facial nerve.

In two cases of temporal space infection, we made our incisions at the level of the top of the external ear, cutting through the temporal fascia to reach the abscess. At times the pus will burrow into the deep temporal space between the temporal muscle and the skull. This pocket must be broken into and a tube deeply placed so as to permit thorough drainage.

Alden[3] states that a great number of his bacteriological studies show the presence of the Vincent's organism and that he routinely gives neo-arsphenamine intravenously (0.4 Gm.) after admission. We have not used this treatment.

CONCLUSION

From July 1, 1939, to July 1, 1940, there were 101 cases admitted to the Plastic Service of Kings County Hospital, with face and neck infections following dental pathological conditions. Of these, forty-one patients recovered under conservative treatment, twenty-three of which were intra-oral spontaneous drainages. Twenty-six patients had internal or intra-

oral incisions. Thirty-four external incisions were necessary, twenty-seven of which showed involvement of the submaxillary space. Twenty of the twenty-seven submaxillary space infections further developed into a definite involvement of the lateral pharyngeal space. Five cases were Ludwig's and each started with a pathological condition in the lower molar teeth. In two of the Ludwig cases, the tooth involved had been extracted two days previously and the following day the socket had been scraped. The symptoms of Ludwig's followed in twenty-four hours. There were two cases of parotid space involvement. Two patients had involvement of the temporal space. There were no retropharyngeal infections in this group.

Of the deaths, we report two cases. One was a fulminating parapharyngeal abscess following tooth extraction and scraping of the socket. This patient was ill for several days before admission and did not respond to surgical treatment. The second case was that of a moron, who was admitted with a submaxillary space infection and a well developed bronchopneumonia.

We offer the following brief outline of the surgical treatment rendered: (a) Careful mouth hygiene (tooth brush, mouth washes), (b) chemotherapy: sulfanilamide, etc., (c) intravenous medication, (d) transfusions, (e) nasal feeding if necessary and practical, (f) incision and drainage promptly done, (g) rubber tube sutured in wound for drainage and postoperative irrigations, (h) tracheotomy done early when indicated, (i) ligation of the external carotid for continued hemorrhage into the spaces, and (j) ligation of the internal jugular vein when involved.

REFERENCES

1. A. L. BECK. Study of 24 cases of neck infections. *Ann. Otol., Rhinol. & Laryngol.*, 42: 741, 1933.
2. L. C. BOEMER. Great vessels in deep infections of the neck. *Arch. Otolaryngol.*, 25–465: 5, 1937.
3. A. M. ALDEN. Neck infections of dental origin. *J. A. D. A.*, 23: 854, 1936.
4. H. P. MOSHER. Submaxillary fossa approach to deep pus in the neck. *Tr. Am. Acad. Opth. & Otolaryngol.*, 20: 36, 1929.
5. G. M. DORRENCE. Acute infections of the soft tissues of the neck. *Surg. Clin. North America*, 17: 1797, 1937.
6. J. F. BARNHILL. Surgical Anatomy of the Head and Neck. Pp. 12, 13, 228. Baltimore, 1937. William Wood & Company.
7. D. J. BARLOW. Surgical anatomy of the neck in relation to septic lesions. Investigation of cervical connective tissue. *J. Anat.*, 70: 548, 1936.
8. H. L. FORD. Deep neck infections, surgical approach. *Illinois M. J.*, 65: 117, 1934.
9. COLLIER and YGLESIAS. Infections of the lip and face. *Surg., Gynec., & Obst.*, 60: 277, 1935.
10. J. BARNHILL. Surgical Anatomy of the Head and Neck. P. 232. Baltimore, 1937. William Wood & Company.
11. GORDEN NEW and JOHN ERICH. Deep infections of the neck. Collective Review. *Internat. Abst. Surg.*, 68: 555, 1939.
12. R. COLP. Treatment of deep infections of submaxillary triangle. *Surg. Clin. North America*, 13: 315, 1933.

DIAGNOSIS AND LOCALIZATION OF INTRA-ABDOMINAL ABSCESSES BY ROENTGENOLOGICAL METHODS*

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THE conventional scout film of the abdomen, taken with the patient lying prone on his back, is of aid in making the diagnosis of an intra-abdominal abscess. If the abscess is large enough, it will be revealed as an area of opacity, with displacement of loops of air-filled bowel. Some of these abscesses contain gas, usually produced by the action of the Bacillus coli organism. However, in the ordinary flat film, this gas is not demonstrated.

FIG. 1. Scout film of the abdomen revealing nothing abnormal.

FIG. 2. Same patient as in Figure 1, in upright position. Arrow points to fluid level within the appendiceal abscess.

We believe, that in abscesses which contain gas, the presence and demonstration of gas-fluid levels in the abscess should be utilized to a greater extent, not only in making the diagnosis but also in helping to determine its relations. By demonstrating the gas-fluid levels, with a horizontal *x*-ray and the patient is several different positions, one can usually get an approximate estimate of the size and boundaries of the abscess.

This is of the utmost importance to the surgeon, because in planning the surgical drainage, he usually has a choice of several incisions; and the type of incision which he will use is determined by the anatomic relations of the abscess to the abdominal wall and to the surrounding viscera.

This is well illustrated by an appendiceal abscess. Such an abscess usually lies in the right lower quadrant of the abdomen, and one should determine whether the abscess is lateral or medial to the cecum. If lateral to the cecum, in the lateral pericolic "gutter," it may extend up along the

* From the Department of Surgery, University of Illinois, and the Surgical and Roentgenologic Service of the Cook County Hospital, Chicago. Presented before the Chicago Surgical Society March, 1941.

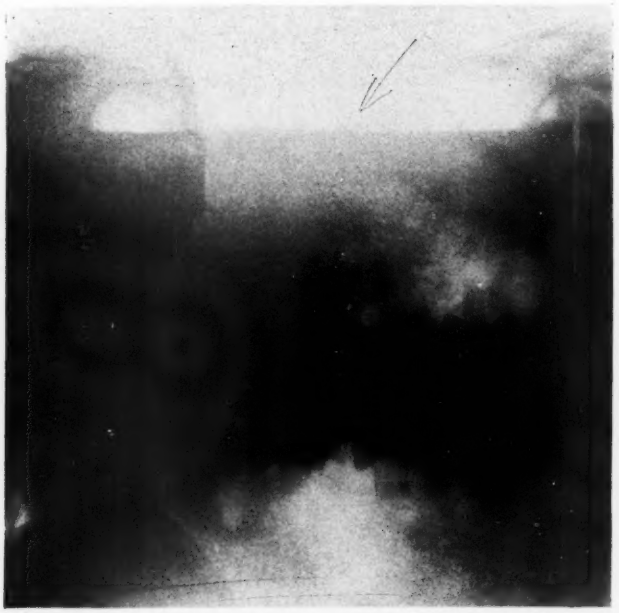

FIG. 3. Same patient as in Figure 1, with patient in a lateral decubitus position showing huge fluid level within abscess. Note that the abscess extends well above the level of the liver and lateral to it so that it may be considered a subphrenic abscess.

FIG. 4. Scout film of abdomen in a patient with a subphrenic and an appendiceal abscess. This film does not reveal anything except distended loops of intestine.

ascending colon. (Case 1, Figs. 1, 2 and 3.) Here the abscess is in contact with the lateral abdominal wall and may be approached through an extraperitoneal lateral route without contamination of the uninvolved bowel and peritoneum and with no danger of spreading the infection.

When the abscess is medial to the cecum, the incision is made more medially and may have to invade the peritoneal cavity. In such a case exact localization of the abscess is invaluable.

In one case in which our patient had a subphrenic abscess following a perforated peptic ulcer, our roentgenologic examination revealed a second smaller abscess in the lower pelvis, medial and inferior to the cecum. Digital examination subsequently revealed this abscess to be perirectal, and when the subphrenic abscess was surgically

Fig. 5. Same patient as in Figure 4, showing a large fluid-gas level in right subphrenic space.

Fig. 6. Reveals that the subphrenic collection of pus is anterior in this lateral upright view.

Fig. 7. Lateral decubitus view reveals the same subphrenic gas fluid level, in the extreme right upper corner of the picture.

invaded, the perirectal abscess was drained very simply by a stab wound through the rectum.

Fig. 8. Reveals a second abscess in the same patient with a fluid level in the right side of the pelvis. The arrow is within the gas portion of the abscess.

In subphrenic abscesses with fluid levels, a right lateral film with the patient in the upright position may be of value in determining whether the abscess is anterior or posterior. In (Case 11, Figs. 4, 5, 6, 7 and 8), the abscess was shown to be more anterior and the drainage, instituted through the anterior abdominal wall, secured approximately 2,500 cc. of purulent material.

In making roentgenologic studies of these cases, it is wise to follow a certain routine sequence. We always do a complete fluoroscopic examination before exposing any films. We first examine the patient lying on his back on the horizontal table, so as to get some idea of where the opacity is and in what portion of the abdomen the abscess is located, as well as to observe the chest and the mobility of the diaphragm. We then turn the table upright so that the patient is in a standing position and we look for a gas-fluid level in the involved area. Then the patient is placed on a cart in front of the vertical fluoroscope, lying on his left side with the right side up, again looking for the extent of the gas-fluid level. In indicated cases a right lateral decubitus view is also of help. It is possible also to examine the patient with a horizontal ray while he lies prone on his back. This permits the determination of contact of the abscess to the abdominal wall. We then take films, one with the patient in each of the above positions. Occasionally, when the abscess is in the right lower quadrant and the cecum cannot be made out fluoroscopically, we inject a small amount of air into the colon through a rectal tube until the cecum is slightly distended. This procedure must be

used with the utmost caution and usually under the fluoroscope, since overdistention of the colon may break up a walled-off abscess.

SUMMARY AND CONCLUSIONS

1. The *x*-ray examination is of value in determining the site and relations of abdominal abscesses.

2. Fluoroscopic examinations should precede the exposure of films with the patient in the upright and lateral decubitus positions.

3. The relations of the abscess to other viscera and the abdominal wall may be determined by the suitable amount of air as a contrast medium.

. . . the treatment of most gastro-intestinal foreign bodies in infants and children should be conservative. Of the manifold substances which are swallowed, 95 per cent will be eliminated spontaneously without symptoms and without danger of injury to the alimentary tract.
From—"Abdominal Surgery of Infancy and Childhood"—by William E. Ladd and Robert E. Gross (W. B. Saunders Company).

EXPERIENCES WITH SPOOL COTTON AS A SUTURE MATERIAL*

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THE use of cotton for suturing is not new; however, it is not widely used. The author became interested in cotton following a visit with Dr. Alton Ochsner at Tulane University in January, 1941. Only six months have passed since I have adopted the use of this material in routine surgery. Although I am reporting on only 150 major surgical procedures, I believe some impressions can be reported at this time.

Gage[1] and Guerry[2] have used fine spool cotton sutures for many years. They reported successful results in personal communications to Dr. William H. Meade[3] and Dr. Alton Ochsner. Ginkovskiy[4] also reported on cotton thread as a suture material in 1936. Following the adoption of this material, Meade and Ochsner[3] reported on the relative values of catgut, silk, linen and cotton as suture materials. Their results are worth noting.

Absorbable sutures heal by "wet healing" while nonabsorbable suture materials heal by "dry healing." The wet type of healing is associated with excessive fluid exudate and a delayed appearance of fibroblasts. The dry type of healing produces a minimal amount of exudate and fibroblastic proliferation appears early. (Fig. 1.) These two factors, namely, excessive exudation and delayed fibroblastic proliferation, which are associated with catgut sutures, delay wound healing. Our experiences with silk and linen have been quite large. Prior to the adoption of cotton we used Pagenstecher linen almost exclusively. The annoyance to both patient and surgeon caused by a draining piece of silk cannot be overemphasized. Since the adoption of cotton as a suture material, we have to date seen no draining sinuses.

Cotton is a vegetable fiber which is easily obtainable. It is inexpensive and easy to sterilize. Cotton fibers have a natural tendency to twist upon themselves. This is not the case with linen and silk. This twisting property of cotton makes it quite impossible to fray out as does linen and silk. Because of this twisting it is difficult for leukocytes and granulation tissue to make any appreciable ingrowth into the suture. Such ingrowths take place quite readily with silk and linen. This may be the explanation for the absence of draining sinuses with cotton. When cotton is spun, it is made up of six cords. There is a mercerized cotton which has a greater tensile strength than natural six-cord cotton. Mercer, in 1930, placed cotton thread in a warm 25 per cent solution of potassium hydroxide for an hour. This produced a shrinking of the fiber with a resulting increase in tensile strength.

Sterilization of this suture material is not difficult. Cotton sutures may be steam autoclaved for ten minutes at fifteen pounds pressure or boiled for twenty minutes. It has been found that if the cotton is wrapped for various lengths around ordinary rubber tubing its tensile strength will not be diminished.

It is a well established fact that the finer the suture material used, the better the result. The days of the No. 3 double chromic catgut seem to be rapidly disappearing. Tissues that have to be pulled together forcibly do not belong together.

We have tried to standardize the technic for cotton usage. No. 24 spool cotton

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either white or black may be used as a single unit cotton technic. K. P. A. Taylor,[5] of Panama, describes this single

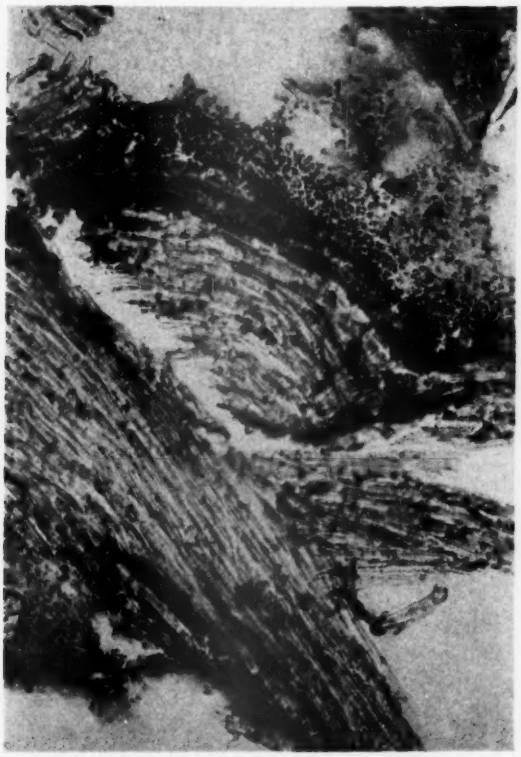

Fig. 1. Anchoring cotton suture removed from common duct on twelfth postoperative day. Note leucocytic response around the suture but no infiltration into suture structure proper. × 260.

unit technic quite clearly. We believe, however, that No. 24 cotton is too thick to be buried in the subcutaneous fat and in suturing of serous surfaces. Therefore, we utilize No. 80, No. 24 and quilting cotton. No. 80 is a very fine cotton thread and requires careful handling. It is used for superficial vessels and in subcutaneous suturing. Quilting thread is equivalent to about a size 50 and has good tensile strength. It is used for all seroserous sutures including purse-string sutures. No. 24 is the suture material which we utilize most extensively. To avoid confusion on our service at the Cook County Hospital of Chicago, we have utilized this single unit No. 24 technic. In other words, No. 24 cotton is used for everything; this means ligating, suturing tissue stumps, vascular pedicles, peritoneal closure, fascial closure, etc. To date we have noticed no ill effects.

Taylor[5] advocates the use of cotton as a

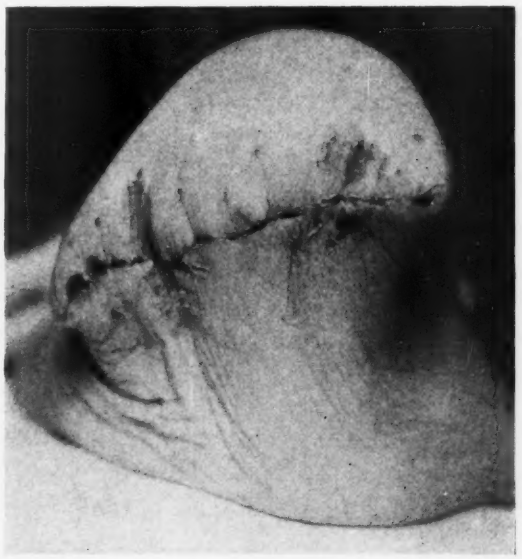

Fig. 2. Supracondylar leg amputation for diabetic gangrene; fourteenth postoperative day; No. 24 interrupted cotton used throughout; no drain.

continuous suture. We, however, have been following the teaching of Halsted, namely, to use nonabsorbable material only as interrupted sutures. It may be argued that this is a long and tedious type of technic but with an operating team that is familiar with this routine, very little time is lost. All of our serosal suturing in gastrointestinal work as well as peritoneal closure and fascial suturing has been done with interrupted sutures. We have had no reason to regret this type of suturing and to date our operating time has been prolonged but little. The incidence of evisceration as well as leaks due to insecure gastrointestinal suturing was entirely absent in our series of cases.

To obtain best results with cotton the assistant should be instructed to cut the sutures as close to the knot as possible. Dr. Michael de Bakey has devised a special scissors for this purpose.

In our utilization of cotton we have attempted to take cases as they came. Whether the case was an interval appendix or a perforated appendix with an already

contaminated wound made no difference. Our series includes such cases as thyroidectomy, mastectomy, gastroenterostomy, gastric resection, Mikulicz procedures for large bowel neoplasms, appendectomy, pelvic surgery, cholecystectomy, common duct drainage, hydrocele, vein ligation, herniorrhaphies, suturing of wounds of the face and amputation stumps. (Fig. 2.) To date we have not used cotton in vaginal or rectal work but it has been used in these regions. We have sutured tendons with routine cotton technic which resulted in good healing and good function.

In gastric resections we have utilized interrupted quilting cotton throughout with the exception of the through-and-through suture line No. 2. For this we use a No. 00 plain continuous catgut. Some surgeons object to the use of absorbable and nonabsorbable materials in the same case. We have never hesitated to use catgut for the through-and-through suture and have had no cause to regret it.

Although we have intentionally used cotton in grossly contaminated wounds for the sole purpose of determining whether or not a sinus would form, up to the present time we have seen no such tracts develop.

I do not wish to state that such wounds never drain. They drain when contaminated and infection ensues. In such eventuality the drainage subsides within a period of from fourteen to eighteen days and the wound heals. We have not been this fortunate with the use of silk and Pagenstecher linen and have abandoned the use of these. Although only nine months have elapsed since the beginning of our use of this suture material, we believe that our efforts were worth while and that our enthusiasm for cotton is justified. Cotton was used as early as 500 B.C. by Susruta.

CONCLUSIONS

1. Experiences with cotton as a routine suture material are reported.
2. Cotton has been found to be a very satisfactory suture material.
3. Its tensile strength in tissues does not diminish as does that of catgut, linen and silk.
4. It is easy to sterilize and is inexpensive.
5. It can be buried in infected wounds without resulting sinus formation.
6. It results in rapid, dry healing without serum accumulation and can be used as a routine suture material.

REFERENCES

1. Gage, I. M. Personal communication from Wm. H. Meade and Alton Ochsner.
2. Guerry, LeGrand. Personal communication to Wm. H. Meade and Alton Ochsner.
3. Meade, Wm. H. and Ochsner, Alton. Spool cotton as a suture material. *J. A. M. A.*, 113: 2230–2231, 1939.
4. Ginkovskiy, V. M. Cotton thread as a suture. *Vestnik. khir.*, 44: 27, 1936.
5. Taylor, K. P. A. Single unit cotton thread surgical technic. *South. Surg.*, 10: 125–131, 1941.

TREATMENT AND CURE OF SEVENTY-SIX CASES OF HYDROCELE BY ONE TWIN-INJECTION OF LITHIUM SALICYLATE AND QUININE HYDROCHLORIDE AND URETHANE

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I BELIEVE that this treatment of hydrocele can replace surgery in all carefully selected cases and save the patient loss of time and also money. All the seventy-six cases were carefully selected from two points of view: First, there had to be no previous tapping or treatments received by such patient. Second, there had to be no other conditions associated with hydrocele, such as hernia or varicocele when this treatment was given. Also the diagnosis had to be certain that it was a hydrocele that such a patient was suffering from, as there are such conditions as spermatocele or malignancy which can be mistaken for hydrocele.

The majority of these patients treated were men for whom confinement in bed for even only a few days might have proved fatal because they were suffering from bad cases of asthma and myocardial failure. This treatment cured them without any setback. The most time lost by any of this series was three days. Every patient was treated in my office and after five to ten minutes' rest they walked out with the end result a complete cure. The first patient treated has had no recurrence after seven years.

Since the commencement of this treatment seven years ago, two of these patients died of myocardial failure four and five years, respectively, after the treatment for hydrocele, and I was fortunate enough to obtain for pathological examination in both cases the scrotum and testes and found complete adhesions of what was formerly the sack of the hydrocele. The wall was completely adherent around the covering of the testicle with no spaces and the scar tissue was not that which we see after a strong irritant is used, but of soft elastic fibrous tissue.

The formula used for this treatment consists of two compounds: (1) 30 per cent lithium salicylate containing 1 per cent tutocain, (2) 2 per cent quinine hydrochloride and urethane.

TECHNIC

Under strict aseptic surgical technic a 10 cc. syringe is loaded with 4 to 6 cc. of lithium salycilate, another 10 cc. syringe is loaded with the same amount of quinine urethane, and one 2 cc. syringe is loaded with sterile water. The scrotum is shaved and washed off with ether and alcohol or any other antiseptic solution. A local injection of about 1 cc. of 1 per cent novocaine in a 2 cc. syringe with a small hypodermic needle is given in the scrotum subcutaneously to render the procedure painless. After the novocaine is injected I insert the needle directly into the cavity. Upon withdrawing the piston, pure amber colored fluid appears in the syringe. This further clinches the diagnosis.

With the eye on the point where the needle penetrated the sack and my left hand grasping the scrotum firmly, I withdraw the needle and push home a 16 gauge spinal puncture needle just far enough to penetrate into the cavity for about half an inch. This needle is only two inches long with a short bevel and is safer to use in such cases. The stylet is now withdrawn, a 30 cc. syringe attached and the sack gradually emptied completely of the fluid. The

syringe is now detached from the spinal needle and the syringe containing the lithium salicylate is attached to the needle and injected into the sack. This syringe in turn is detached and the syringe containing the sterile water is attached to the needle and flushed through with about 1 cc. of sterile water and detached, and then the syringe containing the quinine urethane is injected into the sack. When these two compounds come in contact with each other, they immediately form a very firm, sticky substance.

With the needle still *in situ* and the thumb and finger of the left hand tightly around the needle the hydrocele coverings are gently kneaded with the right hand. The needle is now withdrawn and a piece of elastoplast, the size of a silver dollar, over a pledget of absorbent cotton is placed over the puncture. The patient is allowed to lie quiet from five to ten minutes and is then permitted to get up, wearing a jock strap. He is told to rest in bed for one or two days and if soreness and much swelling occur, he is to apply an ice bag to the scrotum and support the scrotum with a pillow between his legs for twenty-four to forty-eight hours. The swelling that appears reaches its maximum within twenty-four hours and then begins to subside gradually. Within two months one can not tell on which side the hydrocele was originally. On the second or third day the majority of patients have felt well enough to return to their daily routine. All these patients, of course, wear the jock strap until the swelling has subsided.

SUMMARY

Seventy-six patients with hydrocele have been treated and cured by the method of one twin injection of lithium salicylate and quinine hydrochloride and urethane. The average loss of time was two to three days. No hospitalization was necessary in any one case of this series. No complications occurred and there was no setback in any of the patients who suffered from myocardial or pulmonary conditions.

This method, if used in carefully selected cases, may do away with the hazard of surgery and save money and time for the patient.

SURGICAL TREATMENT OF LUPUS OF THE SKIN*

CASE REPORT

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ALTHOUGH the surgical treatment of lupus is not new, it has not yet met the recognition it deserves, especially among dermatologists who are usually the first to see these patients.

As far back as 1890, Vatrin (France) treated lupus by excision and skin grafting. Nelaton (France) and Lang (Vienna) also reported favorably on surgical therapy at the IV International Congress of Dermatology[1] in 1900. With the popularization of Finsen therapy, however, conservative treatment gained the ascendency.

Cauterization, scarification and radiation therapy have often been successfully used in the treatment of lupus. Many cases, however, derive no benefit from these methods, even when employed with the utmost skill. Some do not heal at all; others recur after a temporary seeming cure. In this group surgery is the only resort.

Surgical method of treatment consists of wide excision of the involved area and a safe margin of healthy tissue. The skin is removed in its entirety, together with a thin layer of subcutaneous fat, as lupus lesions usually tend to spread deep into the derm as well as superficially.

During surgery, inoculation of healthy skin must be avoided. Indiscreet use of instruments in handling the tissues is sometimes responsible for recurrences. Injection of an anesthetic through the diseased skin may also be an inadvertent agent of tuberculous inoculation.

Following excision of the lupus area, the raw surface can be skin grafted at once or left to granulate for a short period of time to enhance the taking of the graft. I prefer immediate skin grafting following excision as this simplifies the postoperative care. If part of the skin graft fails to take or becomes the seat of recurrence, the troublesome area can easily be re-grafted later on.

Delay in skin grafting, following excision of lupus area, has the advantage supposedly of improving the blood supply of the wound and permitting elimination of bacteria which might cause a recurrence. However, since a split (thin) graft is used in this type of repair, delay is unnecessary, because of the ease with which a thin graft can be procured.

Following excision of even a small lupus area, it is not usually advisable to try to close the defect by shifting the surrounding skin, because of the possibility of recurrence. This method can be used, however, in cases in which temporary skin grafts have been previously applied and the area has remained free from lesions for a prolonged time.

Tubed flaps are contraindicated for skin covering following lupus excision because of the undue amount of surgery involved in the preparation of these flaps and the danger of recurrence.

The indications for surgery depend upon the size and location of the lesion and the social status of the patient. Small localized areas on any part of the body or face, not involving a cavity or its margin, may be excised for economic reasons, to avoid the protracted treatment usually required in conservative procedures. On the other hand, there are certain *contraindications* which must be strictly respected. Surgery

* Case presentation before the Society of Plastic and Reconstructive Surgery, 1940.

is not indicated in recent cases with rapid extension or in those without definite localization. Neither should it be attempted when the lupus involves margins of cavities, such as the mouth, nostrils, eyelids, etc.

FIG. 1. Lupus vulgaris of the ear and cheek with malignant degeneration of auricle following prolonged treatment including intensive radiation therapy.

As a general rule, one may say that surgery is indicated in those types of skin lupus which are fairly well localized, without tendency to spread, and which resist all conservative therapy. The indications for surgery are strengthened when the lupus lesions have been exposed to radiation therapy for a prolonged period of time with danger of malignant degeneration.

The following case report illustrates the potential danger of protracted treatment of skin lupus and the beneficial results of surgery in such cases:

CASE REPORT

A woman, age forty-two, had been treated continuously for an active lupus vulgaris in a number of dermatological clinics for about fifteen years prior to her appearance in the plastic surgery clinic. The site of the lesion was the left cheek and auricle. Treatment had been of various types, including *x*-ray therapy. According to her history, lupus on the ear had been in existence for about thirty-three years and on the cheek for twenty years. When I first saw the patient in June, 1933, the lupus area extended on the posterior half of the left cheek with active lesions disseminated in an irregularly scarred skin. The left ear had a cauliflower appearance and lobulated, inflamed and ulcerated. In the previous few weeks the ear had become excrutiatingly painful and the swelling had progressed rapidly. No lupus lesions were to be found elsewhere on the body and no other tuberculous process was diagnosed. The tuberculous condition seemed to have been localized on the left cheek and ear for at least two and three decades, respectively, without any tendency to spread. (Figs. 1 and 2.)

FIG. 2. Same patient eight years after amputation of auricle, with wide excision of diseased skin of cheek, followed by free skin grafting. There was no recurrence after surgery.

Pathological examination of a specimen removed from the diseased auricle revealed a squamocell epithelioma. (Fig. 4.) The auricle was amputated with a diathermy knife in July, 1933. There has been no recurrence in that area since.

The patient continued to be treated in the dermatological clinic for skin lupus of the cheek until about 1935. In July of that year, the entire lupus area, as outlined in Figure 3

was excised with a margin of healthy skin of about one-third of an inch. The wound surface appeared greatly scarred with a poor blood

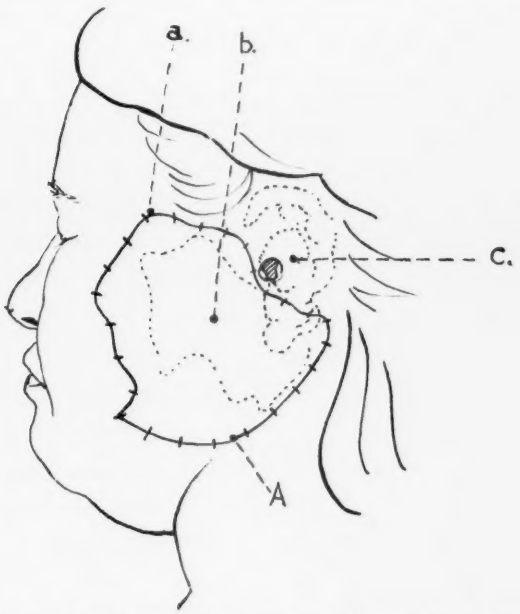

Fig. 3. Diagram outlining free skin graft and its relationship to the lupus areas. *a*, free skin graft; *b*, lupus area of the skin; *c*, amputated oricle.

supply. All scar tissue above the fascia was carefully excised, with proper regard for preservation of the branches of the facial nerve. A thick split graft from the abdomen was sutured into the defect. The usual pressure dressing, with a sea sponge maintained by retention sutures, was applied. The surgery was done in one stage under local anesthesia. (Fig. 2.)

The patient has been seen by us periodically in the eight years since the operation and there has been no recurrence of lupus or epithelioma observed in either the graft or the stump of the auricle. The texture and color of the graft have gradually improved with the passage of years.

SUMMARY AND CONCLUSIONS

1. Surgery is the only resort in lupus cases unaffected by conservative therapeutic measures.

2. Contraindication for surgery exists in rapidly spreading lesions without definite localization and in those involving margins of cavities.

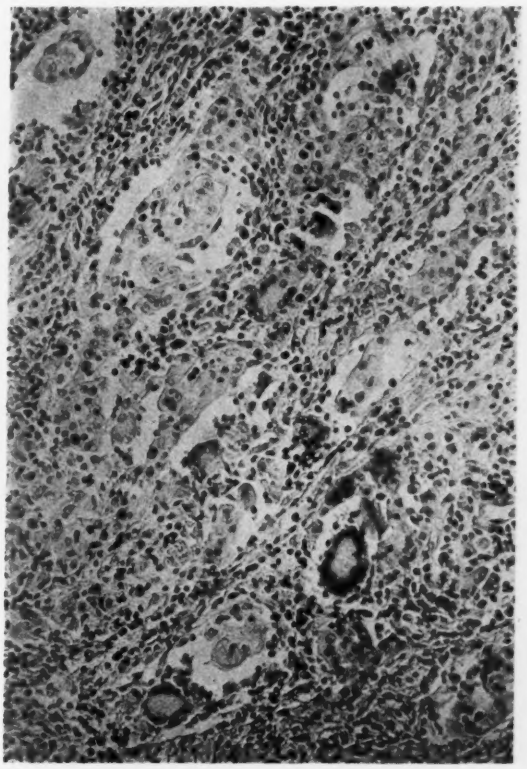

Fig. 4. Microphotograph of specimen taken from ear tumor showing squamocell epithelioma grafted on lupus with secondary acute infection.

3. The surgical procedure of choice is wide excision followed by free skin grafting.

4. A case of lupus vulgaris of cheek and ear of over thirty years' duration is here described. Continuous irritation with physical and chemical agents during prolonged treatment of the lupus had caused malignant degeneration of the ear. There have been no recurrences of either the lupus or the malignancy since surgery.

REFERENCE

1. E. Lang. Sur les resultats de l'extirpation du lupus avec presentation des malades operès et gueris. M. Nelaton. Discussion of this paper-IV. Congress International de Dermatologie et de Syphilographie. Paris, pp. 160–165, August, 1900.

ECONOMIC CONSIDERATIONS OF COSMETIC SURGERY

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FOR a long time the economic aspects of certain plastic operations have been overshadowed by their cosmetic results. This was emphasized several years ago when a fellow member of a hospital staff asked me to do a cosmetic operation on his eyelids. He was the quiet, conservative type, a successful surgeon of twenty-three years' practice. He related an unpleasant experience: An old patient, a woman, had commented adversely on the appearance of his wrinkled and puffy eyelids. Dissipation was intimated. Disturbed, he spoke to his secretary about it and was surprised to learn that she had heard similar remarks. Being of a sensitive nature, he was embarrassed and began to fear loss of his practice. He decided that the most desirable thing to do was to have this condition corrected through a plastic operation. This was accomplished with the result that his appearance was made more youthful and his fears dispelled.

One of my early face-lifting operations was done on an actress who had enjoyed a successful career but had lost everything due to bad financial management. Well past middle life, she was still vigorous, a seasoned and experienced artist, but was unable to work at her profession because of the greatly wrinkled and relaxed skin of her face.

After a successful face-lifting operation she was able to return to her professional activity which was her one means of earning a living. Once more on her feet financially, her self-confidence and popularity restored, she proceeded to write her autobiography, the sale of which continues a source of income to her.

Respect for cosmetic surgery has increased during the past decade. Appreciation of its economic value is more widespread. Middle-aged persons frequently report that a youthful appearance is a more desirable qualification than experience in getting a job. Patients seeking this type of surgery for economic reasons come from many fields of endeavor.

SELECTION OF PATIENTS

In a judicious selection of patients for operation the surgeon is obliged to refuse a fair number for the following reasons: It should be emphatically impressed upon the patient that no miracles are to be performed. Only a more youthful appearance will result with a diminution in the size and number of wrinkles and folds of the face and neck. For the well-balanced, reasonable person, this is a distinct improvement which is thoroughly appreciated. Unless the surgeon is certain that the patient will take a sensible attitude toward the results, he will save himself considerable trouble by refusing to operate.

PREPARATION FOR OPERATION

Preparation must be complete. The night before the operation the patient's hair is clipped and shaved in that part of the scalp where the incisions are to be made. After shampooing, the scalp and hair are soaked in tincture of metaphen and wrapped in a sterile dressing. Just before the operation, the scalp and hair are again soaked in tincture of metaphen and the face and neck painted with the same solution. Soaking of the hair in this way insures asepsis and keeps the hair out of the wound. It is well to occlude the external auditory canal with sterile cotton to prevent its filling with fluid.

ANESTHESIA

Patients prefer local anesthesia and it possesses certain advantages for the opera-

tor. Novocaine 2 per cent containing 15 to 20 drops of adrenalin per ounce, supplemented by extensive injections of normal saline solution. This serves the purpose of diluting the anesthetic, making it easier to obtain a plane of cleavage and elevating the skin and superficial tissues further from the seventh nerve and the nutrient vessels supplying the skin and cartilage of the external ear. Also, there is less bleeding and one may at any time ask the patient to perform various degrees of facial expression. Sufficient preparation for the anesthesia consists of 3 gr. of nembutal by mouth, given in divided doses; one-half the dose the night before the operation, the remaining dose two hours before the operation, and ⅓ of a grain of pantapon given hypodermically one-half hour before beginning the anesthesia.

OPERATION

To obtain best results, the operation is done in at least two stages: first, the cheeks and neck, and if necessary, the forehead; followed in from ten to twelve days by the eyelid plastic operation and any minor corrections that will be mentioned later. In Figure 1 A are shown the line of the temporal-peri-auricular incision and the pattern and amount of skin to be removed. Arrows denote direction and extent of skin undermining. Proceeding cautiously is protection against injury to pre-auricular vessels and aids in finding a plane of cleavage, but once found the dissection can be accomplished rapidly. The slight bleeding can be controlled with hot pads. Ligatures are seldom required, but if needed, they should include a minimum amount of tissue, thus prevent-

A B

FIG. 1. A, shows incision, pattern and amount of skin to be excised. Arrows denote direction and extent of undermining. Sutures demonstrate skin being elevated to new position. B, shows position of suture line after closure. Hair can be combed backward and downward immediately after removal of sutures, concealing the scar.

A B

FIG. 2. A, shows incision and pattern of skin to be excised from the eyelids. B, shows position of scar line after sutures are removed.

ing fibrous nodules from forming under the skin. The greatest bleeding occurs in the scalp and therefore this part of the incision is made last. The use of tissue forceps, if largely dispensed with, will prevent trauma to the wound edges and permit a more rapid healing. Also it will prevent scarification of the facial skin. Fine hooked retractors really serve better for holding the tissues. The extent to which the skin is undermined varies with the individual case. A fairly good immediate result can be obtained with very little undermining. However, an important factor which con-

A B

FIG. 3. A, lateral view of patient before operation. B, lateral view of patient after operation.

A B

FIG. 4. A, frontal view of patient before operation. Note lateral eccentricity of chin and subcutaneous appearance of mandible just below right angle of mouth. B, frontal view of patient postoperatively. Note correction of depression in cheek accomplished by dermofat graft placed through submental incision. Folds about the cheeks and mouth are smaller and fewer. The same is true of the neck.

tributes to the quality of the result is the contractile action of the newly formed fibrous tissue under the skin.

A week after the operation there is a subsiding of the skin of the cheek. It is for this reason that the eyelid plastic operation is postponed. If the forehead skin shows signs of age sufficient to require operation, it can be shortened by a suprafrontal incision just inside the hair line. In undermining the skin in this area one may encounter large superficial veins and considerable trouble will be saved by carefully dissecting around them.

A B

Fig. 5. A, lateral view of patient before operation. B, lateral view of patient after operation. Note change in appearance of upper eyelid in profile. Also note that patient does not have to cover ear with her hair.

Sutures in Figure 1 A demonstrate the skin of the cheek being elevated to the supra-auricular position. The greatest tension on the suture line is in the scalp. Heavy braided silk No. 19 sutures serve well to control bleeding and firmly approximate wound edges; also the heavy silk cuts the skin less than the finer sutures. Absolute approximation guards against infection and expedites healing. Fine silk sutures No. 1 will serve to approximate the skin in the peri-auricular area. A few interrupted sutures of catgut placed subcutaneously at the base of the tragus reduce any possible tension at this part of the suture line and snuggle the skin close to the fascia forming the normal pre-auricular escarpment without which an artificial appearance is produced.

Deformities that are inconspicuous may become prominent after an operation if not corrected at this time. I refer to deformities such as inequalities in the lateral halves of a lip or a lateral eccentricity of the chin, very wide nostrils, scars or moles.

A pressure dressing is applied to the operated area for from forty-eight to seventy-two hours, which is followed by lighter and smaller dressings. Sutures in the cheek can be removed eight to ten days postoperatively; sutures in the scalp should be left in ten to twelve days. Patients are usually quite comfortable and can get out of bed in forty-eight hours; in fact, some leave the hospital while waiting for the second stage of the operation.

Removal of the redundant skin of the eyelids can be accomplished by using the incision shown in Figure 2 A. The scarline placed near the lower lid border is shadowed by the eyelashes. The wound edges cleanly cut and approximated by the use of fine needles and interrupted sutures of

silk will leave a scar so inconspicuous that it is visible only on studied inspection. Slight undermining of the skin is sufficient.

FIG. 6. Shows patient smiling; no compromise of expression.

Extensive undermining may produce contractile scar tissue. The small amount of bleeding can be controlled by the use of hot pads or clamping; no ligatures are required. Ectropion can be an unpleasant result if too great an excision of the skin is done in either the horizontal or diagonal axis. The greatest tension is placed on the lower lid when the eyeball is rotated upward. I find it helpful to have the patient's eyes in this position when estimating the amount of skin to be removed from the lower eyelid. In the upper eyelid a very large amount of skin can be safely removed but it is not necessary. In fact, too much removal produces an artificial appearance. The scarline here is concealed in the fold of the eyelid, shown in Figures 2 A and 2 B. The sutures are removed in from eight to ten days. As in the cheek operation, the result begins to appear when the scar tissue contracts, making the skin fit more snugly.

Familiarity with the use of these incisions is helpful in operating for other conditions about the face. I have used the cheek incision to advance skin upward to the hair line or downward over the mandible or toward the ear to remove or conceal visible scars of the face; also, in repairing injuries to the cheek where a sliding graft of retro-auricular skin is to be advanced into the pre-auricular area, giving skin of similar tint to the face; in elevating the skin of the cheek after doing a muscle transplant for the relief of seventh nerve destruction and also for the cosmetic removal of cheek tumors. I have used the upper eyelid incision to remove a dermoid cyst from under the eyebrow and forehead, and the lower lid incision for the removal of small tumors high up in the cheek; and the suprafrontal incision is used for the removal of tumors of the forehead.

TREATMENT OF POSTOPERATIVE PARATHYROID TETANY WITH OVARIAN HORMONES

REPORT OF TWO CASES

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IT has been frequently observed that hypoparathyroid tetany occurs or increases in severity at the menstrual period (Holtz,[7] Hoxie,[8] Swinton[16]). No definite explanation of this phenomenon has been forthcoming. One reason offered has been the loss of calcium in the blood. It is highly questionable that the loss of calcium in the menstrual flow could account for the onset of tetany even in someone with hypoparathyroidism. Furthermore, as pointed out by McCullagh and Kearns[13] the attack may precede the menstrual flow. In fact in our own two patients, symptoms of tetany usually were noted about twelve hours before the period started.

There is reason for suspecting a close relationship between the sex glands and the mechanism which regulates the calcium level. It has been suggested that the ovaries are part of this mechanism. Those authors who have had the opportunity to observe cases of postoperative tetany have remarked on the large proportion of females who are afflicted (Freyburg,[6] Swinton,[16] Spingarn and Geist[15]). This may be due to the great number of thyroidectomies done on women. At the Mayo Clinic, for example, the proportion of females to males was 3 to 1 (Boothby[4]). One is struck, however, by the fact that in the Mayo series of 13,300 thyroidectomies with a tetany incidence of 1.5 per cent there is not one case of tetany in the male.

The similar chemical structure of the sex hormones and vitamin D also seems significant. These substances are related to the sterols. According to Dodds, Cook, Hewett and Lawson ergosterol possesses estrogenic activity (Kurzrok[9]).

The occurrence of tetany in pregnancy points to an endocrine influence. One can of course, attempt to explain this on the basis of the withdrawal of calcium for fetal development. Zondek[18] believes it to be due to a disturbance of equilibrium in the endocrine system which governs calcium metabolism. Bodansky and Duff[3] consider the possibility of a disturbance of the parathyroids in pregnancy but see no gonadogenic etiology.

Unfortunately, the investigations concerning the influence of the gonads on the calcium level have been conflicting. The experimental results to date can be divided into three groups: (1) Those who claim no influence of the sex hormones on the calcium level; (2) those who claim a decrease in the calcium level and occurrence of tetany, and (3) those who claim an increase in the calcium level.

1. Cheymol and Guinquand removed the ovaries in dogs and found no change in the calcium level (Kurzrok[9]). Marlow and Koch[11] after experimenting with fowl and rats conclude that "to assume that an ovarian hormone controls the level in pregnancy is not well founded." Bodansky and Duff[3] were unable to convert latent into active tetany in rats by the injection of human placental extracts.

2. Holtz and Rossman[7] carried out experiments on dogs using both male and female sex hormones. They conclude that follicular hormone (estradiol benzoate) causes a drop in blood calcium and even acts as an antagonist to dihydrotachysterol. It should be noted here, however,

that the decrease in calcium was slight, 1 to 2 mg., not much more than might be expected as a deviation within normal limits. They found no significant change after progesterone or androsterone administration. They recommend *x*-ray castration although the cure is not permanent. The latter fact is not explained by them. The dihydrotachysterol need, according to these authors, drops after castration but the blood calcium levels are not given. Hoxie[8] describes a case treated by *x*-ray castration with no relief until parathormone was given. Mathieu and Barnes[12] found that theelin and theelol decreased the blood calcium in thyroparathyroidectomized dogs. Here again there is no great change in the calcium level. Maranon, Richet, Pergola and Lesueur[10] found that the administration of estrogen to a female patient caused latent tetany to become active while corpus luteum substance had the opposite effect. They speak of a "premenstrual estroginemia."

3. Doisy[5] demonstrated an increase in the serum calcium of birds after massive doses of estrogen. Similar results have been reported by Allen.[1] Riddle and Dotti and Pfeifer and Gardner[14] report a rise in the blood calcium of pigeons after the administration of estrogen. Bach[2] gave estrogen to female rats and found an initial fall in the excretion of calcium followed by an increased excretion.

This problem concerning the relationship of tetany to the menstrual period occurred to me in treating a patient with postoperative tetany. Her symptoms were not severe except at the beginning of the menstrual flow. Shortly before the menses she had mild symptoms and not infrequently at this time actual attacks of tetany. These attacks responded to calcium therapy and we were about to start dihydrotachysterol to prevent them but the question as to why the tetany appeared only at the beginning of menstruation remained unanswered.

At the end of the premenstrual phase the concentration of ovarian hormones in the blood is low. This is especially true of the corpus luteum hormone (Kurzrok[9]). I wondered whether there might not be some relation between the calcium level and the hormonal concentration. With this in mind 5,000 International Units of estrogenic hormone were given to the patient, who claimed the next day that she felt much better. This, of course, was highly subjective and it was decided, with the permission of the patient, to carry out the experiment in greater detail. In addition, I was fortunate to have another patient whose monthly attacks at the menstrual period could not be controlled with even 12 cc. of dihydrotachysterol daily.*

METHOD

Each patient was treated at the menstrual period with estrogen, progesterone or a combination of both in oil injected intramuscularly. The estrogenic substance was estrone. Blood specimens were taken at about 10 A.M. Calcium determinations were made almost daily during the menses and the patients were asked to note subjective symptoms. On patient No. 2 so many blood specimens had been taken that at times we had to forego a few tests so as to spare her veins. The calcium determinations were done by the modified Cramer and Tisdall method.[17]

CASE REPORTS

Case 1. F. R. P., a white, married female had a bilateral thyroidectomy on April 14, 1934, at the age of twenty. Pathological report was: Diffuse macrofollicular colloid hypertrophy of the thyroid gland. She had an uneventful postoperative course and was discharged from the hospital on April 21. That evening the patient noted stiffness in the extremities and during the first week at home her fingers were stiff most of the time. Her first attack of tetany occurred about three months later. She did not have attacks at first but frequently felt very weak and nervous and vomited. She did not consciously relate her symptoms to the menstrual period but

* I am indebted to Dr. Floyd H. Jones for the opportunity to treat this patient.

remembers that after the operation she stayed away from school the first two or three days of each menses. In 1939, she became quite stiff during a menstrual period and was hospitalized. No blood calcium determinations were done during any of these episodes so that there is no report of a low calcium. It was questionable at the time whether the patient had attacks of tetany or hysteria. She began to take 90 gr. of calcium gluconate daily but still had trouble about once a month.

I first saw the patient about the Spring of 1940. At that time she was having a typical tetany attack with carpopedal spasms and a positive Chvostek. The condition was relieved by intravenous calcium. I saw the patient during several menstrual periods. The attacks became more frequent and more severe. Even when she had no attack she had a positive Chvostek and felt miserable. Since her condition was not as severe as that of patient No. 2 we were able to hold off ovarian therapy until her symptoms were upon her and her calcium had dropped. She was not very co-operative so that we managed to carry on the experiment for only a short time. Ovarian therapy was begun on September 9, after which her calcium level rose and she improved rapidly. After a few months she felt better generally and since it was difficult to get her into the office for injections and calcium tests, dihydrotachysterol was started. This is taken now only at the menstrual period.

Case II. S. A. L., a white, unmarried female had a bilateral thyroidectomy on November 3, 1938, at the age of twenty-two. The pathological report was: Diffuse colloid goiter and one parathyroid body. The patient was quite restless postoperatively and vomited frequently. That night she was nervous, had a severe headache and slight epistaxis occurred. The next day she complained of numbness in the arms and legs and in the evening appeared "exhausted." On November 7, she began to cry because of pain in her hands. The hands and feet began to stiffen, the jaw became stiff and typical carpopedal spasms occurred. Ten cc. of calcium gluconate and 10 cc. of calcium levulinate intravenously brought relief, after which calcium gluconate 7½ gr. every four hours by mouth was started. Her menses began about 11 A.M. on November 8, and on that day she had an attack of tetany. This, like all her tetany attacks was treated with calcium levulinate intravenously. She suffered attacks of tetany intermittently, the last one of the month occurring on the twenty-fifth. The next menstrual period began on December 6 and on the 7 she was in tetany. On December 10 the administration of dihydrotachysterol was started with 30 m. daily. The stiffness continued and hence the dihydrotachysterol was increased to 40 m., and 1 cc. of parathormone was given daily. The parathormone was discontinued after a week but the dihydrotachysterol was gradually increased to 8 cc. in one day. In the meantime daily calcium determinations were being done and the dihydrotachysterol regulated accordingly. The menstrual periods were regular and the patient had no more attacks for a time although she was quite stiff, had to go to bed and was given calcium intravenously at every menses. It should also be noted that except on the rare occasion when the calcium level was above ten the patient always had at least a slight Chvostek sign. The Trousseau sign was positive only when the Chvostek was marked.

From December 14 until the month of March the patient was free from actual attacks. In March, an attack of tetany occurred in spite of the administration of 12 cc. of dihydrotachysterol. Tetany again occurred in July and an extremely severe attack in August. There were attacks of lesser severity at other periods.

Early in 1940 the patient began to have typical tetany attacks every month. Between the menses the daily dose of dihydrotachysterol was gradually reduced to 2 cc. About two days before the period was expected the dihydrotachysterol was increased to 6 cc. and on the day the period started she was given 12 cc. In spite of this the monthly attacks continued. In August, she suffered an unusually severe attack which left her extremely weak. Because of the apparent hopelessness of the situation *x*-ray castration was being considered.

On September 17, ovarian hormone therapy was started. The hormones were administered a few days before the period was expected and continued until the danger of tetany was past. The variation in the time of the initial injection in relation to the beginning of the menstrual period (Table III) is due to the delaying action of the ovarian hormones on the menses and also, of course, to the occasional variation in the periods themselves. The treatment was repeated for five periods during

which the patient had no attacks of tetany and only mild, transient symptoms such as tingling in the fingers. One cc. of parathormone was given once for such symptoms after the September period.

At the end of January, 1941, her blood calcium rose to 12.1 mg. per cent (Table III) and the patient displayed symptoms of hypercalcemia including nausea and extreme lassitude. All medication and calcium were stopped. At this time a small, firm nodule about 1 cm. in diameter was noted in the center of her neck over the thyroid cartilage. This nodule was definitely not present two months before and has not grown appreciably in size since its discovery.

The patient received no more ovarian hormones after January 28. She had one attack of tetany between the February and March menstrual periods but none since then. During the March menses 6 cc. of dihydrotachysterol were given daily for three days. The calcium gluconate has been decreased to 60 gr. daily and the intermenstrual dihydrotachysterol to 0.5 cc. daily. The patient is a little weak during the menses and the blood calcium dropped at one time to 6.6 mg. per cent but there have been no marked symptoms of tetany. The lowest calcium level between the menstrual periods has been 7.6 mg. per cent.

COMMENT

Table II contains one period of Case II when she received dihydrotachysterol but no hormones. The other tables show the results of ovarian administration during the menses.

In Table I we see that there was not only improvement in this patient's condition after the symptoms became manifest but there seems to be even a corresponding rise in the blood calcium. It will be noted in Table III that the blood calcium dropped as low as 5.0 mg. per cent. Previous to the institution of this form of therapy when the patient received only calcium and dihydrotachysterol the lowest calcium level was also 5.0 mg. per cent but she had repeated attacks of severe tetany. It can also be seen that tetany does not necessarily always occur at the lowest calcium level.

I suspect that the nodule in the patient in Case II is parathyroid tissue which, however, was not present when the ovarian therapy was begun. It would indeed be a strange coincidence if any remaining parathyroid tissue just happened to start growing when the treatment was instituted. In both cases progesterone seems to have been more effective. I do not know what effect other estrogenic compounds such as

TABLE I

TREATMENT IN CASE I WITH OVARIAN HORMONES DURING MENSTRUAL PERIODS

Date	Estrogen I. U.	Progesterone Mg.	Blood Ca. Mg. Per Cent	Clinical Notes
9–7	.....	..	9.1	Breathing sl. difficult
8	.....	..	8.9	Same; menses started
9	.....	2	6.5	Nervous; tired; feels "stupid"; nausea
10	.....	..	7.9	Same in A.M.; better subjectively in P.M.
11	.....	..	9.4	Breathing much better; sl. nausea
12	.....	..	....	No nausea; feels good; menses stopped
13	.....	..	9.6	Feels fine
10–5	.....	..	....	Nervous; irritable; breathing sl. difficult
6	.....	..	10.7	About the same
7	10,000	..	5.2	Breathing very difficult; "stupid"
8	10,000	..	7.5	Better; more alert; breathing same
9	10,000	..	9.0	Does not feel "stupid"; menses
10	.....	..	7.8	Worse last night; better this A.M. Good in P.M.
11	.....	..	9.0	Good
14	.....	..	....	Fine; menses stopped
12–3	.....	..	....	Good until today; sl. nervous
6	5,000	5	9.4	Breathing difficult; nervous; "stupid"
7	.....	..	9.6	Sl. better
8	.....	..	7.5	Definitely better; nervous; not "stupid"
9	5,000	5	9.0	Same
10	2,000	1	8.2	Good except headache
11	.....	..	....	Much better
15	.....	..	....	Fine; menses stopped

estradiol might have. In Case II (Table III) the estrogen was decreased because of the possibility that it may have caused the dysmenorrhea.

TABLE II

TREATMENT* IN CASE II WITH DIHYDROTACHYSTEROL DURING ONE MENSTRUAL PERIOD

Date	Dihydrotachysterol Cc.	Blood Ca. Mg. Per Cent	Clinical Notes
6–22	2	10.7	Good
25	6	....	Good
26	6	8.2	Tingling in fingers
27	12	5.0	Menses started; tetany attack Calcium i. v.
29	12	6.0	Carpopedal spasm: calcium i. v.
30	12	7.2	Better; still tingling
7–1	6	....	Better
3	6	8.8	Weak but better
6	6	5.4	Tried to get up; felt numb all over
10	2	8.0	Good

We certainly cannot draw the conclusion that the calcium level was kept high by means of this therapy. There are two other possibilities which present themselves. First, the ovaries, although they may have no direct effect on the calcium level, regulate the neuromuscular excitability of the body. This theory has been advanced by McCullagh,[13] and is borne out by Table I in which the patient had a low calcium but no tetany. Secondly, in one patient, the intermittent administration of ovarian hormone over a period of several months may have stimulated the remaining parathyroid tissue to grow. This is very hypothetical since we do not even know for certain that the described tumor is of parathyroid origin. Cramer[4] says that an excess of estrogen can cause a marked enlargement of the parathyroid glands. The patient, however, showed immediate improvement before the nodule was noted. Furthermore, the patient in Case II had relief without the occurrence of any nodule.

TABLE III

TREATMENT IN CASE II WITH DIHYDROTACHYSTEROL AND OVARIAN HORMONES DURING MENSTRUAL PERIODS

Date	Estrogen I. U.	Progesterone, Mg.	Dihydrotachysterol Cc.	Blood Ca. Mg. Per Cent	Clinical Notes
9-17	.....	5	2	7.0	Good
18	.....	5	2	.....	Good
19	.....	5	2	6.0	Fingers stiff for few seconds in A.M.
20	.....	5	2	5.2	Good today
21	.....	5	6	6.6	Good; a little weak
22	.....	5	6	6.8	Same
23	.....	5	6	.....	Same
24	.....	5	6	7.8	No pep; weak
25	.....	5	6	.....	Better but not much pep
26	.....	5	6	6.3	Menses started last night
27	.....	5	6	5.6	Good; no symptoms of tetany
28	.....	..	6	8.1	Good
10-19	10,000	..	6	.....	Feels good
20	10,000	..	6		
21	10,000	..	6		
22	10,000	..	6	.....	Tingling in extremities. Trousseau positive
23	10,000	..	6	6.7	Aches all over; menses started and stopped for a few hours Abdominal cramps
24	.....	..	6	6.7	Better; still has low abdominal cramps
25	.....	..	6	5.9	Weak; no tetany
26	2,000	..	6	6.4	Weak
27	5,000	..	6	5.0	Hands felt numb for few seconds in A.M.
28	.....	..	6	5.8	Better but weak
29	.....	..	2	5.0	Good
11-20	.....	..	2	9.7	Feels good
21	5,000	5	6	.....	Aches all over. Sl. nausea No tingling
22	5,000	5	12	6.6	Fingers tingled in A.M. Better in P.M. Menses started last night
23	5,000	5	12	7.5	Vomited last night. Good today
24	5,000	5	6	5.8	Weak but feels good. Trousseau positive
25	.....	..	6	6.1	Good. Not so weak
26	.....	..	6	.....	Fine
28	.....	..	2	7.4	Fine
30	.....	..	2	.....	Menses stopped
12-16	5,000	5	2	.....	Felt good until today; very weak
17	5,000	5	2	.....	Still weak
18	5,000	5	6	.....	Weak but no symptoms of tetany
19	5,000	5	6	7.6	Better today
20	5,000	5	6	.....	Weak last night; good today
21	5,000	5	2	.....	Weak during night; better today
22	5,000	5	2	.....	Weak today
23	5,000	5	2	7.07	Better today; still somewhat weak
24	5,000	5	2	.....	About same
25	5,000	5	6	6.8	Vomited last night; menses No tetany
26	5,000	5	6	6.8	Weak; no tetany
27	5,000	5	6	.....	Low abdominal cramps
28	.....	..	6	7.5	Better
29	.....	..	2	7.8	Feels fair
1-1	.....	..	6	6.7	Menses stopped; slight tingling in hands
3	.....	..	2	7.6	Feels fine

TABLE III (*Continued*)

Date	Estrogen I. U.	Progesterone, Mg.	Dihydrotachysterol Cc.	Blood Ca. Mg. Per Cent	Clinical Notes
1-21	2,000	5	6	.....	Feels fine; menses due today
22	2,000	5	6	.....	No pep
23	2,000	5	6	.....	Good today
24	2,000	5	6	7.8	Fair today; no pep
25	2,000	5	6	.....	Low abdominal cramps
26	2,000	5	6	.....	Menses started; severe dysmenorrhea
27	2,000	5	6	7.8	Severe cramps; no tetany
28	2,000	5	6	9.4	Cramps less severe; headache
29	.....	..	..	10.1	Nausea; calcium and medication stopped
30	.....	..	..	12.1	Menses stopped

Purely from this investigation one cannot recommend the routine use of ovarian hormones in the treatment of tetany. For one thing, in most cases there is no need to look further when we have such a splendid calcium regulator as dihydrotachysterol. I believe, however, that we can definitely conclude that the ovaries have some influence on the condition of tetany. The change from monthly tetany attacks to no attacks during the menses is striking. These results, although not conclusive, warrant further research in the same direction.

It is, of course, difficult to compare this work with that of other similar investigations since the majority of these have used experimental animals. My results, for example, would not tend to substantiate the contention of Holtz[7] that follicular hormone lowers the calcium level and acts as an antagonist to dihydrotachysterol. The latter's experiments were carried out on dogs.

It might be well to note that an attempt was made by us to investigate the action of ovarian hormones on dogs.* Only two dogs were used, one as a control, so that the results are by no means conclusive. We noted, however, no difference in either of the thyroparathyroidectomized dogs after the administration of ovarian hormones to one dog. This was also true after the ovaries were removed. Both dogs displayed symptoms of tetany about the same time and their calcium levels showed little difference. It would be interesting to see the results if one parathyroid body were left *in situ*.

* The experimental work was carried out with the assistance of William K. Nowill, M.T.

SUMMARY

Two female patients suffering from postoperative tetany had their attacks chiefly at the menstrual periods. Administration of ovarian hormones led to the following conclusions:

1. The ovaries may influence the neuromuscular excitability of the body.

2. In these patients the ovarian hormones did not depress the blood calcium level and they did not act as an antagonist to dihydrotachysterol. On the contrary, in one patient the dihydrotachysterol need seemed to be decreased.

3. The clinical benefits noted in these two patients justifies further carefully controlled study and use of ovarian hormones in similar cases.

Since this article was submitted for publication the patients have received no sex hormone therapy. The patient in Case II has had two moderately severe attacks of tetany.

REFERENCES

1. Allen, E. Ovarian hormones and female genital cancer. *J. A. M. A.*, 114: 2107, 1940.
2. Bach. Quoted from Albright, F., Smith, P. H. and Richardson, A. M. Postmenopausal osteoporosis. *J. A. M. A.*, 116: 2465, 1941.
3. Bodansky, M. and Duff, V. B. Regulation of the level of calcium in the serum during pregnancy. *J. A. M. A.*, 112: 223, 1939.
4. Boothby, W. M., Haines, S. F. and Pemberton, J. deJ. Postoperative parathyroid insufficiency. *Am. J. M. Sc.*, 181: 81, 1931.
5. Doisy, E. A. The estrogenic substances. Glandular physiology and therapy. *J. A. M. A.*, 116: 501, 1941.
6. Freyburg, R. H., Grant, R. L. and Robb, M. A. Hypoparathyroidism. *J. A. M. A.*, 107: 1769, 1936.
7. Holtz, F. and Rossman, F. Ueber Beziehungen der Sexual-hormone zum Kalkstoffwechsel und zu den Nebenschildruesen. *Ztschr. f. Geb. und Gynäk.*, 116: 199, 1938.
8. Hoxie, G. H. A case of parathyroid deficiency. Endocrinology, 16: 358, 1932.

9. Kurzrok, R. Endocrines in Obstetrics and Gynecology. Pp. 80, 176, 191. Baltimore, 1937. Williams and Wilkins Co.
10. Maranon, G., Richet, C., Pergola, A. and Lesueur, G. La tetanie, secondaire a l'hyperfolliculineme. *Ann. d'endocrinol.*, 1: 142, 1939.
11. Marlow, H. W. and Koch, F. C. The effect of sex hormones on blood calcium and inorganic blood phosphate levels. *Endocrinology*, 21: 72, 1937.
12. Mathieu, F. and Barnes, O. The effects of theelin and theelol in latent tetany. *Am. J. Physiol.*, 105: 172,1933.
13. McCullagh, E. P. and Kearns, J. E. The relationship between the parathyroid glands and sex hormones in tetany. *Endocrinology*, 19: 532, 1935.
14. Pfeifer, C. A. and Gardner, W. U. Skeletal changes and blood serum calcium level in pigeons receiving estrogens. *Endocrinology*, 23: 485, 1938.
15. Spingarn, C. L. and Geist, S. H. Hyperparathyroidism and pregnancy. *J. A. M. A.*, 113: 2387, 1939.
16. Swinton, N. W. Postoperative parathyroid tetany. *New England J. M.*, 217: 165, 1937.
17. Todd, J. C. and Sanford, A. H. Clinical Diagnosis by Laboratory Methods. Philadelphia, 1937. W. B. Saunders Co.
18. Zondek, H. The Diseases of the Endocrine Glands. Baltimore, 1932. William Wood & Co.

Lying as the toxic nodular goiter does, between the colloid goiter on the one hand and the degenerated cardiotoxic goiter on the other, the diagnosis must determine whether there is thyroid toxicity in the one instance, and an absence of general constitutional changes, notably cardiac insufficiency, in the other.

From—"Diseases of the Thyroid Gland. Presenting the Experience of More Than Forty Years"—by Arthur E. Hertzler (Paul B. Hoeber, Inc.).

POSTPARTUM APPENDICITIS*

REPORT OF TWO CASES

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APPENDICITIS during pregnancy has received much attention from the obstetrical world during the last twenty years so that its frequency, diagnosis and treatment is well known. On the other hand appendicitis having its onset during the puerperium has had little or no consideration. While undoubtedly an uncommon complication, it is such a serious one it must not be overlooked.

Babler,[1] in 1908, reported twenty-eight puerperal cases in his collective series of appendicitis associated with pregnancy and Findley,[2] in 1912, mentioned three cases. Since 1912, however, the English literature has been barren on the subject except for a case report of Sellers[3] in which he described a ruptured appendix discovered at operation on the fourth postpartum day. The foreign literature has been more productive. Jerlov[4] collected thirty-five cases from seventeen general hospitals and four lying-in hospitals in Sweden between 1900 and 1920. Fatyol[5] found only one such complication in 26,000 deliveries at the Toeth Gynecological clinic of Budapest. Marmasse[6] described a case of a gravida 1 who had a thirty-six hour labor terminated by forceps and who developed right lower quadrant pain thirty-six hours after delivery. A ruptured appendix was discovered seventy-two hours after the onset. Schulz[7] wrote of a similar case from the University Clinic which had its onset a few hours after delivery and in whom a suppurative appendix was found thirty-six hours later. Marmasse and Schulz discussed the diagnostic features involved, but the majority of the reports merely mentioned this condition as an entity which occasionally may be encountered.

It is evident from the above reports that appendicitis occurring in the puerperium is rare. Most cases were diagnosed late or not at all, hence the disastrous delay resulted in a high incidence of appendiceal rupture and general peritonitis. The following two cases are presented because they probably illustrate most of the diagnostic problems involved. A possible common etiological factor also was observed. They represent the only cases of acute appendicitis diagnosed in the puerperium in 17,489 deliveries at the Swedish Covenant Hospital of Chicago (a general hospital) from 1916 to 1939 inclusive.

CASE REPORTS

CASE 1. Mrs. J. W., age twenty-nine, gravida II was admitted June 21, 1939 in labor. Her past history was negative for serious illnesses. The prenatal course was normal except for a mild attack of pyelitis in the fourth month. This cleared up promptly on urotropin and sodium acid phosphate. She was delivered spontaneously of a 9 pound 10½ oz. male infant after eighteen hours of labor. Temperature and pulse were normal; hemaglobin, 90 per cent, red blood cells, 4,200,000, white blood cells, 11,000. The puerperium was uneventful until after an ounce of oleum racini was given on the morning of the third day. She had three bowel movements during the afternoon. About 9 P.M. she began to complain of mild cramp-like pains in the epigastrium and vomiting occurred once at 2 A.M. The pain became stronger and constant and by morning had localized in the right flank and lower right quadrant. At 9:30 A.M. her temperature was 101.4°F. (rectal), pulse 100, white blood count, 13,800. A catheterized urine specimen showed no white blood cells. The abdomen was flat. The uterus was 8 cm. above the symphasis and not tender to move-

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ment. There was no adnexal tenderness. The lochia appeared normal.

There was marked tenderness high in the right quadrant, but no rigidity. The kidney was not tender. Diagnosis: Acute appendicitis. A consultation with a urologist and a general surgeon was held, both of whom agreed with the diagnosis, although a perinephritis was considered because of the previous history of pyelitis. The patient was observed for six hours during which time the pain increased and rigidity appeared in the right flank. The white blood count rose to 17,000.

Operation was performed June 25, 1939 at 6 P.M., twenty-one hours after the onset. A large dark red and fibrin-covered appendix was found retrocecal, bound down with firm adhesions. It was removed and the abdomen closed with drainage. Pathological diagnosis: "Acute suppurative hemorrhagic appendicitis." The postoperative course was uneventful; the drain was removed on the fourth day and the patient was discharged on the twelfth postoperative day with the wound healed.

Case II. Mrs. F., age twenty-seven, gravida III was admitted in labor September 15, 1929. Her prenatal course had been normal and there was no history of previous attacks of appendicitis. She was delivered of a 7 pound infant after an eight hour labor. The puerperium was normal and afebrile for eight days when she received 1 dr. of cascara twice for constipation. During the following day she complained of mild cramps in the lower right quadrant, but had no bowel movement. Her temperature was 100.6°F. in the evening. On September 25, 1929 the temperature remained about 101°F., the pain remaining mild but becoming localized to a spot 5 cm. medial and 5 cm. above the right iliac crest. The following day the pain had become very severe and rigidity had developed over the lower right quadrant. The white blood count was 23,900 and the temperature had risen to 103.6°(R).

Operation was performed under ethylene anesthesia at 3 P.M. September 26, 1929, fifty-four hours after the onset of symptoms. An unruptured, retrocecal, gangrenous appendix was found. The appendix was removed and the abdomen closed with drainage. The temperature returned to normal on the tenth postoperative day and the patient was discharged on the sixteenth postoperative day with slight drainage from the abdominal wound.

ETIOLOGICAL FACTORS

Neither patient gave a history of previous attacks of appendicitis although both evidently had had trouble as evidenced by the dense adhesions found at operation. The attack of pyelitis experienced by the first patient early in pregnancy may well have been a mild attack of appendicitis. The high incidence of previous appendiceal pathology when the disease complicates pregnancy is a common observation. Our findings in these two cases would lead one to believe that this is equally true in puerperal cases.

Another common factor was noted: Both patients received a strong cathartic a few hours before the onset of symptoms, the first patient as a matter of routine and the second because of constipation. It is very suggestive that the resulting strong peristalsis flared up a slumbering infection of the appendix.

DIAGNOSIS

The onset of symptoms in Case I was almost the classical picture of acute appendicitis. The pain began in the epigastrium and after a few hours localized to the right lower quadrant. Vomiting occurred only once. The onset in Case II was slower, but finally the pain and tenderness became severe and localized to the right lower quadrant. It was observed that the tenderness and rigidity was higher in the abdomen than usually is seen in appendicitis. The explanation can be made on an anatomical basis. Baer[8] demonstrated conclusively that the appendix is displaced upward after the third month of pregnancy, reaching as high as the iliac crest by the sixth month. It does not return to its normal position until ten to fourteen days after delivery.

This upward displacement of the appendix in the peritoneal cavity should also influence the patient's reaction to the infection. The temperature could be expected to be higher and the pain more severe than if the appendix had been a pelvic organ. The temperature in Case I

reached 101.4°F. and in Case II 103.6°F. which is higher than one usually encounters in acute, unruptured appendicitis. Both patients complained of more pain than in the average case and it was the severity of the pain as well as the higher location that was the main factor in ruling out early puerperal sepsis or pelvic thrombophlebitis. The pain in early puerperal infection is generally slow in onset and of a minor nature. The uterus is subinvoluted and tender to movement. When the parametria are involved, pain and tenderness is present deep in the groin. No uterine or adnexal tenderness was elicited in either patient. The lochia may provide a clue as to the true nature of the difficulty. Within forty-eight hours the lochia of an endometritis becomes serous, seropurulent, or foul smelling if the infection is saprophytic. The lochia of the patients in question remained normal. A flareup of a gonorrheal salpingitis seldom begins before the seventh day and the findings usually are limited to the pelvis. A positive history of previous infection would be significant here.

The laboratory provides little aid in this condition. The normal puerperal white blood count may vary from 9,000 to 25,000 so that the leucocytosis observed meant little although the increasing white blood count was believed to be of some significance. A negative catheterized or clean specimen should help to rule out pyelitis in the abscence of a previous history. When pyelitis has been present, pus in the urine is to be expected, but sudden absence of pus accompanied by pain may indicate an acute obstruction of a ureter. Such a differentiation had to be made in Case I. It was believed that the absence of pus with no kidney tenderness and the rapidly changing symptom complex were enough to rule out pyelitis.

TREATMENT

Little need be said about treatment. It differs not at all from that of acute appendicitis observed at any other time. One hesitates to subject a woman who has just delivered a baby to a laparotomy, but the consequences of too long a delay are probably more serious here than at any other time because of the changed anatomical relations and the possible weakened condition of the patient due to her labor. The difficulty in making the diagnosis is bound to cause some delay so that the incidence of rupture and consequent mortality will be higher. The fear of surgery should not further complicate an already complicated picture.

SUMMARY

The literature of postpartum appendicitis is reviewed and two cases occurring in the early puerperium are presented.

The outstanding features of these cases are discussed in relation to the differential diagnosis of some of the common complications of the early postpartum period, namely, pyelitis, early puerperal sepsis and salpingitis.

It is suggested that the cathartic given to both patients shortly before their onset of symptoms may have been an etiological factor.

The treatment recommended is surgery as soon as the diagnosis is made.

REFERENCES

1. Babler, E. A. Perforative appendicitis complicating pregnancy. *J. A. M. A.*, 51: 1310, 1908.
2. Findley, P. Appendicitis complicating pregnancy. *J. A. M. A.*, 59: 612, 1912.
3. Sellers, N. E. Acute appendicitis during pregnancy and the puerperium. *J. M. A. Alabama*, 5: 187–191, 1935.
4. Jerlov, E. Appendicitis during pregnancy and puerperium. *Acta obst. et gynec. Scandinav.*, 4: 6, 1925.
5. Fatyol, C. Acute appendicitis during the course of pregnancy. *Orvosi hetil.*, p. 166, 1934.
6. Marmasse, J. Acute appendicitis as a sequela of labor. *Presse méd.*, 38: 1122, 1930.
7. Schulcz, A. Acute appendicitis after childbirth. *Gyógyászat*, 73: 33–34, 1933.
8. Baer, J. Appendicitis in pregnancy. *J. A. M. A.*, 98: 1359–1364, 1932.

REGIONAL ANESTHESIA FOR HIGH LIGATION OF THE INTERNAL SAPHENOUS VEIN

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LIGATION of the internal saphenous vein and its tributaries at the junction of the former with the femoral vein is a common procedure in the treatment of varicose veins of the lower extremity. Its value need not be defended here.

The operation is almost always performed under local anesthesia because the danger of embolism is minimized by moderate activity of the patient soon after the operation. Ochsner and Mahorner[1] state: "Simple ligation can be considered as being practically without danger if the patient is not allowed to remain in bed during the post-operative period."

Descriptions of the anesthesia for high ligation of the internal saphenous vein are usually limited to mere statements that local anesthesia or infiltration of the line of incision should be used.

The recognition[2] of the fact that the operation will fail if it is improperly or incompletely performed should focus attention on the best type of anesthesia to be used.

Labat[3] distinguished between regional anesthesia and local anesthesia. He stated: "Regional anesthesia is a result of a certain number of delicate surgical procedures by which it is possible to control pain temporarily by interrupting the sensory nerve conductivity of any region of the body. Motor function is occasionally interfered with. Regional anesthesia is best realized by injecting an anesthetic solution in the immediate vicinity of the nerves supplying the operative field. It is commonly called local anesthesia; but it differs from local anesthesia in that the anesthetic fluid is never injected along the line of incision or within the structures of the surgical wound."

It is the purpose of this paper to call attention to a field block described by Labat for ligation of the internal saphenous vein at the fossa ovale. Personal experience with the method has verified its value. The anesthesia is complete; it permits a thorough painless exposure of the structures of the fossa ovale so necessary to the successful performance of the operation. The method is slightly more elaborate than infiltration of the line of incision but the quality of the resulting anesthesia is more satisfactory. Any one experienced in regional anesthesia knows that a field block is less painful than the method of injecting an anesthetic solution and operating until pain is experienced and then repeating the process one or more times.

METHOD

The anterior crural nerve is first blocked. A skin wheal is raised just below Poupart's ligament 1 cm. lateral to the femoral artery. With a finger holding the femoral artery medially, a needle 5 cm. long, unattached to the syringe, is introduced through the skin wheal in a direction perpendicular to the surface of the skin and advanced until the resistance offered by the fascia iliaca is overcome. The needle is then gently advanced about 1 cm. farther until paresthesias, which radiate toward the knee or inner side of the thigh or leg, are induced. Without moving the needle the syringe is connected and 5 cc. of a 2 per cent procaine hydrochloride solution containing adrenalin hydrochloride 1:100,000 are injected. It is hardly necessary to state that the solution is never

injected without first aspirating to determine that the point of the needle is not within the lumen of a blood vessel. If the point of the needle does not reach the nerve by the first puncture, the needle is partly withdrawn and its direction slightly changed outward, then inward, care being exercised to keep the finger on the femoral artery retracting it medially if necessary to protect it from the point of the needle. If paresthesias are not induced, the anesthetic solution is distributed fan-wise beneath the fascia iliaca.

Next the obturator nerve is injected. With the thigh slightly abducted the pubic spine is defined and a skin wheal raised just below and lateral to it. A needle 8 cm. in length, unattached to the syringe, is introduced through the skin wheal in a direction perpendicular to the skin surface and advanced toward the horizontal ramus of the pubis. When the needle impinges on the bone, it is partially withdrawn, its direction changed by inclining its shaft a little inward and downward, and reintroduced until its point again comes in contact with the bone. The upper wall of the obturator canal is then felt and the needle passed beneath it and advanced 2 cm. further, keeping close contact with the upper wall of the canal and following its direction outward, backward and upward. An injection is then made of 10 cc. of a 1 per cent solution of procaine hydrochloride containing adrenalin hydrochloride 1:100,000 while the needle is slightly moved to distribute the solution along the obturator canal. Paresthesias are exceptionally induced during these manipulations, anesthesia being secured by diffusion of the solution in the connective tissue in which the nerve is imbedded.

A skin wheal is now raised at the apex of Scarpa's triangle. Intradermal and subcutaneous injections are now made from this wheal along the sartorius and adductor longus muscle up to Poupart's ligament and along the ligament. These injections require about 60 cc. of a 0.5 per cent procaine hydrochloride solution containing adrenalin hydrochloride 1:100,000.

SUMMARY

Attention is called to Labat's field block for ligation of the internal saphenous vein and its tributaries at the fossa ovale. This field block is superior to haphazard infiltration anesthesia; it permits a perfect painless exposure of the structures involved, so necessary to the successful performance of the operation.

REFERENCES

1. Ochsner, Alton and Mahorner, Howard. Varicose Veins. P. 106. St. Louis, 1939. C. V. Mosby Company.
2. Stalker, L. K. and Heyerdale, W. W. Factors in recurrence of varicosities following treatment. *Surg., Gynec. & Obst.*, 71: 723, 1940.
3. Labat, Gaston. Regional Anesthesia. P. 1. Philadelphia, 1923. W. B. Saunders Company.

Case Reports

STAB WOUND OF THE HEART*

REPORT OF TWO CASES IN WHICH SUTURING WAS SUCCESSFUL

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SINCE the first successful cardiorraphy by Rehn[1] in 1896, the literature has revealed an ever increasing number of cases in which successful suture of the heart has been performed. The report of such a case is, therefore, no longer a novelty. However, a recording of these cases with an analysis of the factors involved gives the surgeon invaluable material for study. In this way, principles and procedures may be elaborated to render the incidence of success higher. With this in mind, these two cases are presented. They are consecutive and have been handled in the same manner:

CASE REPORTS

CASE 1. J. H., colored male, aged forty-five years, came to Harlem Hospital by taxicab and was admitted at 12:40 A.M. April 19, 1938, with a history of stab wound of the left chest inflicted thirty minutes previously. On admission the patient was conscious and oriented but in severe shock with pulse absent and blood pressure not obtainable. Diagnosis was made of stab wound of the heart with pericardial tamponade and left hemopneumothorax. On the way to the operating room a chest *x*-ray was taken. No stimulants were given but morphine sulfate, gr. ¼, was administered and preparations were made to give at the appropriate time saline infusion and a blood transfusion.

Clinical examination revealed two stab wounds of left chest: (1) A one-inch stab wound below the junction of the inner and middle third of the clavicle, running downward and penetrating the second interspace just outside the left border of the sternum. This was a sucking wound. There was no crepitation in the soft tissues about or around the wound. (2) A one-inch wound one inch above and just medial to the left nipple, coursing down and medialward, severing the fifth costal cartilage one-half inch from the sternal border. From this wound there issued a continuous flow of dark red blood.

It was estimated that operation was performed about one and one-half hours after infliction of the wounds. General anesthesia (ether) was given. A skin incision was made along the left sternal border to the fourth interspace, then curved outward and downward to and about one and one-half inches below the nipple. Carrying the skin incision down to rib cartilage, a skin-fascia-muscle flap was dissected up, exposing the cartilages of the fourth and fifth ribs. The cartilage of the fifth rib was seen to be severed. The fourth and fifth cartilages and about one inch of both ribs beyond the costochondral junction were removed. As soon as the chest was opened, the collapsed left lung was seized by sponge forceps and held firmly so as to stabilize the mediastinum. This was the old device Müller[2] used to combat the immediate ill effects of an open pneumothorax.

The pericardium was greatly distended and blood flowed freely from a one and one-half inch wound on the anterior surface. This wound was enlarged in the axis of the heart in

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order to obtain adequate exposure. Bleeding was profuse and there were few clots. On the anterior surface of the heart, apparently the right ventricle, was a wound about three-quarters of an inch and at right angles to the long axis of the heart from which dark red blood gushed with each systole. The rhythm of the heart was irregular and could be appropriately termed "a crazy, fluttery" rhythm. Two Allis clamps applied to the wound edges brought them together and gave temporary closure. Three figure-of-eight sutures of fine silk, tied with the heart in systole, closed the wound; almost immediately, the arrhythmia ceased and there was no further bleeding from the heart. The posterior aspect of the heart was inspected and found intact.

FIG. 1. J. H., operated upon April 19, 1938; picture taken June, 1938, two months postoperatively.

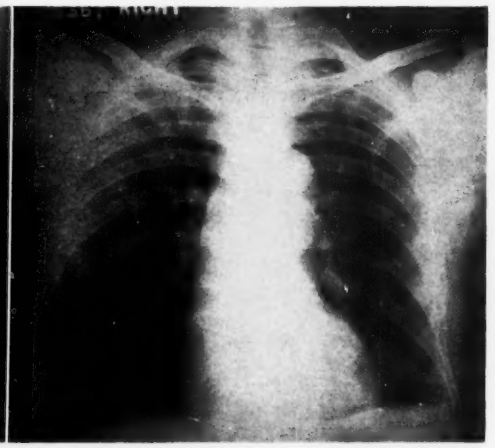

FIG. 2. J. H., operated upon April 19, 1938; *x*-ray taken January, 1941, two years and nine months postoperatively. Patient sustained stab wound of heart.

There seemed to be about 300 cc. of blood in the pleural cavity and the same amount in the pericardial sac. As much as possible of this was removed manually and by suction but a small quantity was left in the pleural sac. The pericardium, after all bleeding points were secured along its cut margins, was left open widely. Hemostasis was of obvious importance because, as the patient reacted favorably, bleeding increased along the lips of the pericardial wound. The lung was marsupialized (extrapleuralized), suturing it to the periphery of the thoracotomy wound. This anchored the lung and gave mediastinal stabilization. The upper and lower lobes of the lung were then sutured together at that part of the interlobar fissure which presented in the extrapleuralized portion of the lung. For all practical purposes the closure was now airtight. Suture of the fascia-muscle flap was done and then the skin closed making closure of the chest as airtight as possible. A wick of iodoform gauze was packed in the lower stab wound. The upper stab wound, a sucking wound, was closed tightly by suture. Underwater drainage was established in the midaxillary line in the third left interspace.

Immediately following suture of the heart wound, an infusion had been started. This was subsequently replaced by a transfusion of 500 cc. of citrated blood.

On his return to the ward, an oxygen tent was used. Because of difficulty in reaching the patient for clinical observation and therapy, it was discarded within twelve hours in favor of nasal catheter and mask. This facilitated closer observation, more effective treatment and nursing. Oxygen was given in this manner during the first three weeks. Underwater drainage was maintained for three days. During the first day, the patient gave evidence of increasing respiratory difficulty. At the same time it was observed that the underwater drainage had ceased to function and pneumothorax reading was definitely positive. The needle was removed and found to be clogged. It was cleaned, re-introduced and re-attached; air blew off, some fluid began to drain from the chest and the patient experienced great relief almost immediately. On the third day with no further drainage of air or fluid and with a normal pneumothorax reading, the needle was removed. Subsequently, re-establishment of

underwater drainage was never clinically indicated.

The blood pressure improved following operation and on the fourth day was stabilized at 120/90. The pulse rate remained between 100 and 150 during the first two days and by the fourth day was 90. Thereafter, it varied little, never rising above 100. A moderate temperature of 100 to 101°F. during the first two weeks was associated with a massive pleural effusion, which did not become infected despite three tappings. Eventually, with resorption of this fluid and organization, the temperature came down to normal in seven weeks and remained so thereafter. The patient was discharged sixty-nine days after operation.

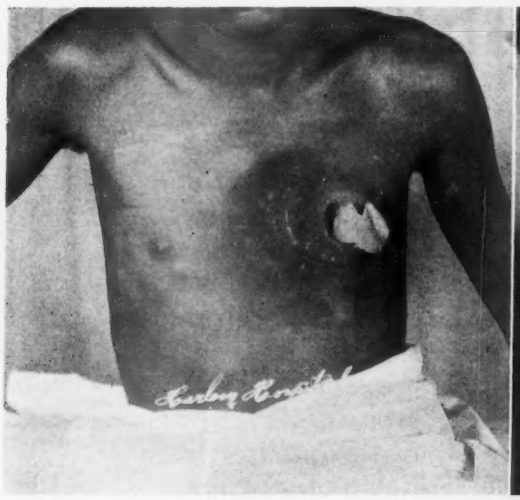

Fig. 3. N. S. Patient sustained stab wound of heart. He was operated upon in June, 1938. This picture was taken two months and ten days postoperatively.

Fig. 4. N. S. This *x*-ray was taken January, 1941, two years and seven months after accident.

Case II. N. S., a colored male, aged nineteen years, was admitted to Harlem Hospital at about 10:55 P.M., June 18, 1938, with a history of stab wound of the left chest inflicted fifteen minutes previously. On admission, the patient was conscious and oriented but apparently in great distress. He was dyspneic and cried out for the severity of the pain in his precordium. On reaching the ward, the patient experienced a short period of unconsciousness with a profuse and clammy sweat. His pulse was above 130 but of fair quality; his blood pressure was 130/80 at this time. He was ordered to the operating room immediately with a diagnosis of stab wound of the heart. On the way, a chest *x*-ray was taken.

Clinical examination revealed a one-inch stab wound just to the inner side of the left nipple running down and medialward penetrating the thorax in the fourth intercostal space. This wound was definitely a sucking wound.

It was estimated that operation was performed about one hour and twenty minutes after the stabbing. General anesthesia (ether) was used.

As with Case I, the chest was entered by the transpleural route. There was a wound about a half inch in length on the anterior surface of the pericardium toward the left border and apex; through this, blood gushed intermittently. This wound was enlarged in the axis of the heart giving full and adequate exposure. To the left of the interventricular sulcus and about an inch from the apex, was found an irregular wound about 1 cm. in length from which issued with each contraction of the heart, small jets of blood. Using an Allis clamp on either side of the wound for approximation and temporary closure, two figure-of-eight sutures, one No. 0 chromic, the other fine silk, were used to give an effective permanent closure. There was still profuse bleeding, however, prompting further investigation. A second myocardial wound was discovered a quarter inch to the right of the interventricular sulcus and close to the diaphragmatic border. One figure-of-eight suture of fine silk did not effectually close this wound, so it was supplemented by another. The case was handled subsequently in the same manner as Case I, with pericardium left widely open and extra-

pleuralization of the lung to the periphery of the thoracotomy wound. At the operating table it was decided that the upper or the wound in the left ventricle could be considered the wound of entrance and the lower or wound of the right ventricle was the wound of exit. Surprisingly, the diaphragm was not injured. There was about 500 cc. of blood in the pleura and about 200 cc. in the pericardial sac. Remembering the morbidity, incident to a sizable quantity of blood left in the pleura in Case 1, all blood, fluid and clotted, was removed as completely as possible.

Following operation, the patient became extremely restless, noisy and violent to a rather alarming degree. Morphine was ineffective but pantopon was highly efficacious as a sedative. Narcotics were unnecessary after two days. Thereafter the course was uneventful and uncomplicated. The patient was out of bed on the fourteenth day and discharged July 12, 1938, twenty-five days after operation.

COMMENT

In both cases, the pericardial wounds were situated above and were larger than the wounds in the myocardium. Such a physical arrangement, a valve-like affair, interfering with a free and complete egress of blood from the pericardium, incarcerates blood in the pericardial sac, preventing a vital blood loss in the pleural cavity or to the outside through the parietal wound. Thus, there is developed what has been called pericardial tamponade,[3] a compression which is as necessary for the immediate survival of the patient from acute hemorrhage as it is inevitably fatal if this compression is unrelieved in due time. In both cases, tamponade developed and existed about one and one-half hours without fatal consequence. This, we think, is a significant observation.

After closure of the myocardial wound all other bleeding must be thoroughly controlled, bleeding from the cut pericardium, lacerated lung, the vessels of the parietes, the internal mammary and the intercostal vessels.

Despite the fact that airtight closure may be effected after suture of the thoracic wound, and despite stabilization of the mediastinum by fixation of the lung to the parietes, the pneumothorax which is present in the left chest may persist or may increase to produce a tension pneumothorax. Such a tension pneumothorax may, through compression, decrease the vital capacity not only of the left but of the right lung and bring about exitus. Underwater drainage should, therefore, be instituted in all cases both for therapeusis and prophylaxis. A needle with practically no bevel and of adequate bore is desirable. Drainage should be checked frequently to be certain of the mechanical integrity of the device. If the needle is ineffective because it becomes clogged or abuts on lung surface, intercostal tube drainage should be established. A fairly large sized stiff tube (definitely not a catheter) should be used.

The removal of all blood from the pleural cavity unquestionably influences the morbidity. This was strikingly illustrated by the second case in which blood and clots were completely removed from the chest.

In both cases, the phase of acute cardiac reaction incident to trauma and repair (manifested by an extremely rapid and irregular pulse) did not last beyond the third day.

The transpleural approach employed is recommended because it gives direct, quick and easy access to the pathological condition. It is certainly desirable in those cases in which the wound has traversed the left pleural cavity, with the existence of an open pneumothorax as is the case in sucking wounds.

Silk sutures are recommended but fine chromic catgut may be satisfactorily used.

Sulfanilamide was used in both cases during the first week and in the first case for at least two weeks. This is recorded as a matter of fact. It is obviously impossible to speak with any conviction as to its influence in either case.

CONCLUSIONS

In conclusion, one may feel certain that the successful suture of a heart wound will depend on: (1) *The location and size of the*

wound and the nature of the heart muscle. I mention this last factor because I have seen a stab wound in the heart muscle of almost jelly-like consistency in which sutures could not be successfully applied, resulting in death on the operating table. (2) *Associated injuries:* laceration of great vessels, laceration of internal mammary artery, etc. A wound of the right chest, sucking in nature, producing a pneumothorax on the right side, may cause immediate fatal results, if not instantly recognized and treated by closure and drainage for decompression. Associated injuries in other parts of the body, abdomen and extremities, may alter prognosis. (3) *Thorough parietal hemostasis.* (4) *Control of pathologic physiology: tension pneumothorax and lung fixation (mediastinal stabilization).* This latter is desirable but not imperative when positive pressure anesthesia is employed. (5) *Infection:* Prophylaxis—(a) Open pericardium; (b) minimum blood and clots in the thoracic cavity; (c) the use of sulfanilamide.

REFERENCES

1. Graham, Singer and Ballon. Surgical Diseases of the Chest. P. 309. Philadelphia, 1935. Lea & Febiger.
2. Sauerbruch and O'Shaughnessy. Thoracic Surgery. P. 24. Baltimore, 1937. William Wood & Co.
3. Rose, E. Herztamponade. *Deutsche Ztschr. f. Chir.*, 20: 329, 1884.

It is nearly always a serious mistake to administer an anodyne to relieve pain caused by a splint.
From—"A Manual of the Treatment of Fractures"—by John A. Caldwell (Charles C. Thomas).

THE EXPERIMENTAL SCLEROSIS OF THE GALLBLADDER*

PRELIMINARY REPORT

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SURGERY of the biliary tract is the second most common operation performed in general practice. A study of the morbidity and mortality rates shows that the average mortality of cholecystectomy is approximately 10 to 15 per cent.[1,2] There are two reasons for this: (1) *the immediate causes:* e.g., peritonitis, hemorrhage, pulmonary complications, heart disease and so-called shock; and (2) the *predisposing causes:* e.g., insufficient preoperative care and the inexperience of the surgeon in the anatomical, physiological, pathological and surgical aspects of biliary tract disease. The former are partially controllable, the latter are less so.

For the sake of discussion it can be agreed that the following statements are true: (1) Peritonitis (infective or chemical) may be the result of a ligature slipping off the cystic duct, or it may follow bile seepage from the liver; (2) hemorrhage can occur if the cystic artery ligature slips off, if the artery is not tied or if "oozing" is profuse from the liver bed; (3) lung complications are more likely to follow surgery which hinders normal postoperative respiration (traumatizing procedures in the upper abdomen); (4) heart complications may be precipitated by a long anesthetic (anoxemia), a long operation, pneumonia, etc.; (5) shock is increased by "manhandling" vital structures, a long anesthesia and a long operation.

On this basis it seemed logical to formulate the following hypothesis: If the gallbladder could be removed from the digestive tract without incurring the above potential dangers, it might be possible to lower the mortality and morbidity rates without increasing the incidence of unfavourable postoperative results. In other words, if the gallbladder could be removed without cutting the cystic duct, there would be less chance of either an infective or a bile peritonitis, without cutting the cystic artery there would be less chance of hemorrhage, and without removing the gallbladder from the liver bed there would be less chance of hemorrhage, infection or bile seepage. If all this could be accomplished by a short, simple and safe procedure, the time required for the operation would be lessened, the quantity of anesthetic would be thus reduced and the operation shock minimized. These latter factors would serve to decrease liver damage as well as the possibilities of heart and lung complications. A combination of all should lower the incidence of the causes of death.

The hypothesis was tested experimentally and encouraging results were obtained. Since the idea of sclerosing the gallbladder is new, the findings open a new field for investigation which may prove a justification for publishing this incompleted work.

EXPERIMENTAL PROCEDURES

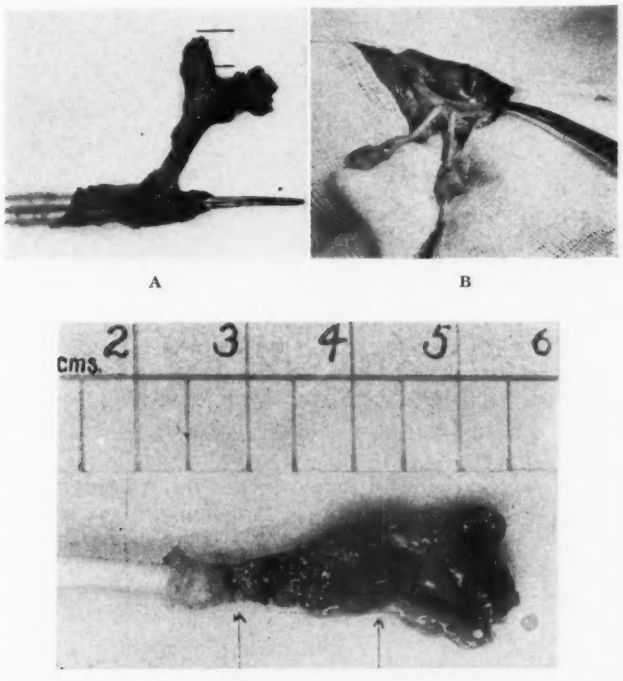
For the sake of brevity the procedures and results will be noted only in so far as they influence the conclusions.

Tying the Cystic Artery. The idea of sclerosing the gallbladder by reducing the

* This work was done in the Department of Medical Research, Banting Institute, University of Toronto, where the author was given permission to put his ideas to the experimental test. The photomicrographs were made in the laboratory of Professor William Boyd. The work reported here is not complete, but it is presented in an unfinished state because it may be some years before this problem can again be studied in detail.

blood supply was born when a sclerosed ovary was found as the result of its blood supply having been severed at a previous operation. Six dogs were operated upon. In only two did the gallbladder become smaller as shown by latter operations; two died of peritonitis due to perforation and in two the bladder was distended, thickened and showed areas of early necrosis. The results were unsatisfactory from the standpoint of sclerosis, but are of great interest because four gallbladders did not perforate even though their blood supply was lost (two were gangrenous). This procedure is too traumatizing to have clinical application.

Tying Both Artery and Duct and Filling the Empty Bladder with Different Sclerosing Agents (50 Per Cent Glucose, Quinine, Sodium Morrubate, Etc.). The results in this group were also unsatisfactory. They showed that the blood supply must be left intact. Only three of the eleven dogs operated upon showed sclerosis and four died of gangrene. The higher incidence of gangrene in this group, as compared with the first, may be due to the handling of the bladder which was necessary when it was injected.



A B C

Fig. 1. Photographs of three sclerosed bladders. A, probe in common duct from which the cystic duct leads to the sclerosed gallbladder. A small piece of liver has also been removed and lies next to the rule. The bladder measures 6 mm. in length; injected for eight months. B, photograph six months after sclerosing. The bladder and cystic duct are on the left. A "tooth-pick" through the common duct and the ampulla are seen on the right. C, shows patent cystic duct with small match in it and the sclerosed bladder attached to the liver (distal). This gallbladder (between the arrows) measures a little over 1 cm. in length; injected four months.

Tying the Duct and Filling the Empty Bladder with Sclerosing Agents. Five of twelve dogs showed, after a period varying from four to six months, a smaller gallbladder, but there were still both macroscopic and microscopic signs of necrosis.

Tying the Duct, Removing the Bile and Washing out the Empty Bladder with Bile Acid Solvents—Then Washing out the Clean

Bladder with Sclerosing Agents and Leaving the Walls in Apposition. The pathological condition resulting from the experimental ligation of the cystic duct is often due, apparently, to the toxic and necrosing effects of the bile acids in the gallbladder bile. It seemed, therefore, that if these could be removed at least one provoking cause of a pathological change (particularly gangrene) would be eliminated. This was done after the cystic duct had been securely tied (catgut, linen, silk) by with-

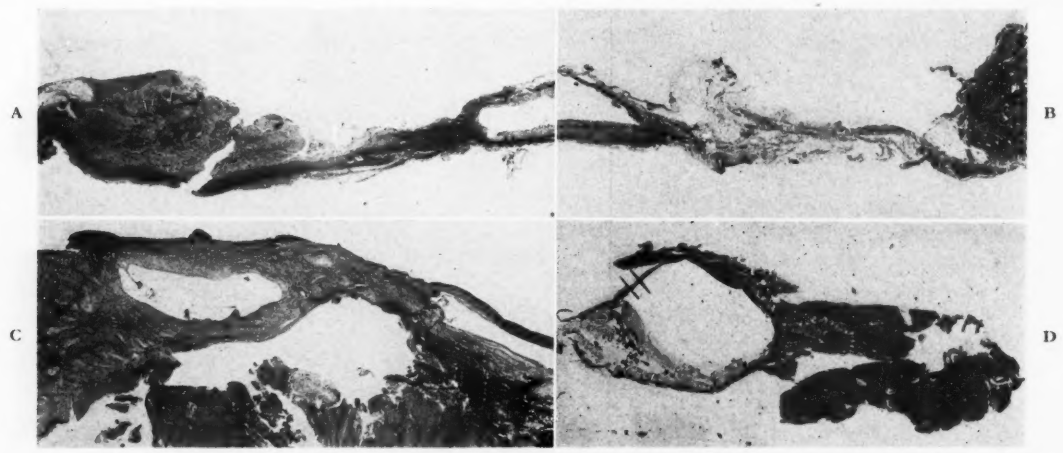


FIG. 2. Low power photomicrographs of the four sclerosed gallbladders. In A, B and C, the cystic duct is plainly seen at the point of constriction. Section D is transverse and sectioned through the center. In C and D the cavity is not completely obliterated and the flat mucosa is readily seen. In C is shown one villus which has escaped the pressure effects. This is also seen in Figure 3D.

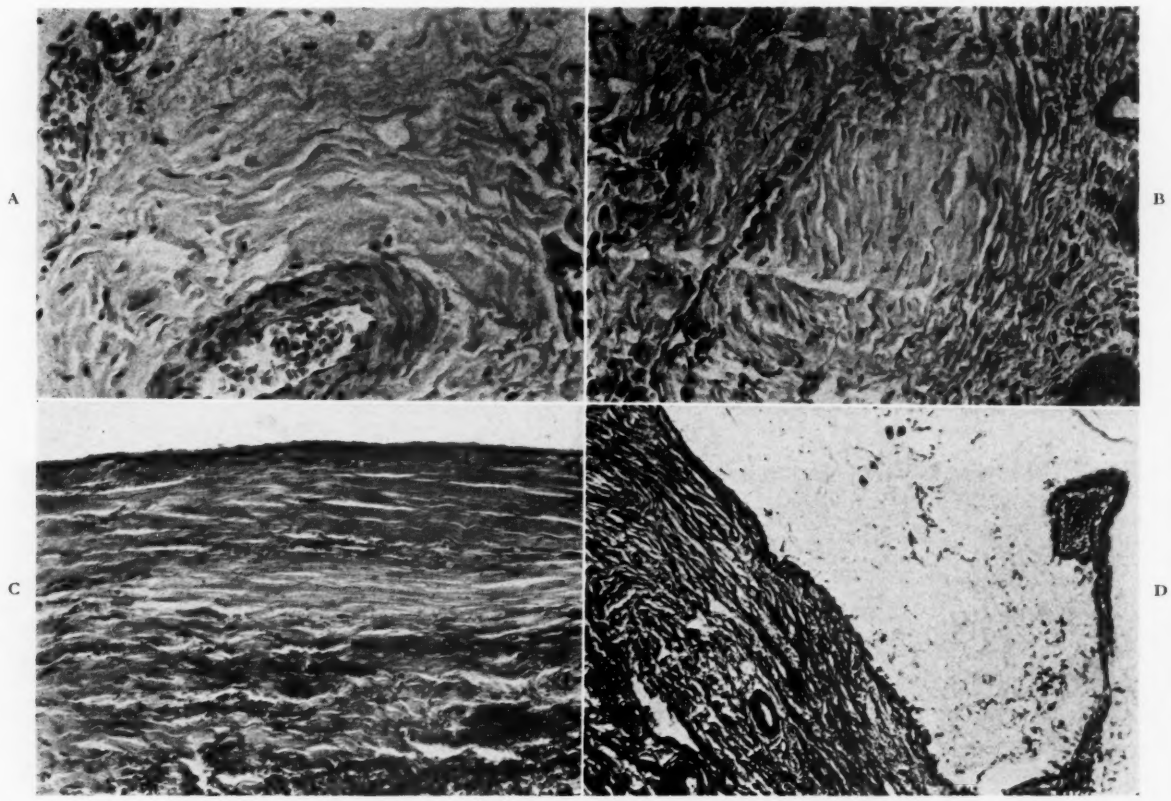


FIG. 3. High power sections of sclerosed bladder wall. A, B and C show the new fibrous tissue. No sign of acute inflammatory reaction can be seen. In C and D the flat epithelium is shown and in D the one villus (Fig. 2C) which has escaped pressure. (How often is such a villus the nidus of a stone?)

drawing all bile from the bladder and cleaning the interior through the same needle with a strong solvent of bile acids (e.g., a 5 per cent aqueous solution of sodium carbonate). This left the bladder as a thoroughly clean and closed bag with a normal blood supply. The same sclerosing agent, opturatin,* was used in all dogs in this series. It was injected into the bladder while the needle was still in place, left in contact with the walls for a few minutes and withdrawn. This withdrawal collapses the walls so that the mucosal surfaces, moistened with the sclerosing agent, are left in contact with each other.

Six dogs were operated upon and two were re-operated upon, one ten days and the other fourteen days after sclerosing. They showed that the immediate reaction is a mucosal secretion with the formation of a mucocele. The end result in the remaining four was a sclerosed gallbladder averaging approximately 1 cm. in size. These are illustrated in the accompanying figures. No ill effects were noticed in any of the animals even though three had previously had experimental ligation of a coronary artery with a resulting infarct, as shown in the electrocardiographs. This is evidence that the procedure is not excessively dangerous and indicates that this is the only safe method of experimental sclerosis so far attempted.

DISCUSSIONS

These experiments upon dogs have indicated that it is possible, in that species at least, to remove the gallbladder as a functional unit (i.e., physiological removal) without the extensive manipulations attendant upon surgical removal. The simplification of the operative procedure greatly reduces the complications which are frequent sequelae of the conventional methods of gallbladder surgery. The finding that the normal gallbladder in dogs can be sclerosed without any remaining inflammatory signs and without damage to the liver is suggestive and presents certain points for clinical consideration.

It would be hasty to conclude from the results presented here that a diseased human gallbladder could be treated in the same way with equally satisfactory results. Even if such a procedure should prove suitable for clinical application it would not necessarily be always the method of choice; no surgical procedure is ever used to the exclusion of all others. Such application would have to be established by a carefully controlled series of patients. Much experimental and clinical work remains to be done but it is hoped that this preliminary communication will at least initiate further work, and thus point the way to possible improvements in the proposed treatment and elimination of many of the potential complications at present associated with cholecystectomy.

Sincere appreciation is expressed to the late Major Sir Frederick Banting for extending the facilities of his laboratory and for his interest, advice and stimulation; to Dr. G. E. Hall* and Dr. J. Janes* for advice and assistance; and to Professor William Boyd in whose laboratory the photomicrographs were made.

REFERENCES

1. MACDONALD, DEAN. A practical and clinical test for liver reserve. *Surg., Gynec. & Obst.*, 69: 70–82, 1939.
2. MACDONALD, DEAN. The gallbladder problem in general practice. *Canad. M. & S. A. J.*, 45: 29–36, 1941.

* Opturatin is a sclerosing agent composed of zinc sulfate, phenol, glycerin, cinnamon water, F. E. pinus canadensis and distilled water.

* At the time this work was done Dr. Hall was Associate Professor of Medical Research. He is now in charge of the Medical Research Division of the Royal Canadian Air Force. Dr. Janes is now a medical officer in the Royal Canadian Air Force.

PARAFFINOMA OF THE NOSE*

CASE REPORT

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PARAFFINOMA was frequently encountered during the first quarter of the present century but now this lesion, with the exception of pulmonary paraffinoma, has become quite a curiosity.

In this country, Hunt,[1] in 1924, reported one hundred cases of paraffinoma encountered during twenty years of his own practice, although from 1920 to 1940 the entire literature shows a total of seventy-nine papers, two-thirds of which were published abroad. Moreover, many of the cases reported in the American literature did not originate here, but were the results of injections performed in various European countries for the purpose of evading military service.

Lipoid pneumonia of the adult type, caused by aspiration of mineral oil into the lungs, is considered a true paraffinoma of the lung. Unfortunately, the incidence of this lesion is on the increase. Ikeda,[2] in 1937, found 106 cases of lipoid pneumonia recorded in the literature from 1925 to 1936. Of these, 64.1 per cent were in infants and children, and 35.9 in adults. Among these adults, 39.5 per cent showed a true lipoid pneumonia of the adult type, the pathology of which Ikeda describes as a true paraffinoma. To these he adds seven cases of lipoid pneumonia in a series of 107 consecutive necropsies of infants, in a period of three years. He has since collected five instances of lipoid pneumonia in adults.

According to Davis,[3] paraffinoma is a "chronic inflammatory process involving skin and adjacent subcutaneous tissues characterized clinically by the development of reddish purple indurated masses, painless, not tender, persistent, not subject to ulceration and, as a rule, ordinarily benign." In the opinion of the same author there must be a special disposition to the formation of paraffinoma, since not all patients who receive paraffin injections necessarily develop tumors. Though usually benign, cases of malignancy attributed to paraffin injections have been reported.

As a rule, after an initial inflammatory reaction of short duration following the injection, the paraffin is surrounded by a thick layer of fibroblasts and may remain a quiescent foreign body for a long time. Occasionally, after a period varying from several weeks to many years (ten years in the case here reported), a secondary reaction may supervene which results in the production of an extensive cellular infiltration and fragmentation of the oily mass. The end result is the elaboration of the characteristic neoplasm which has been designated "paraffinoma."

The suggestion has been made by Johnson[4] that allergy may play a rôle in the secondary reaction leading to tumor formation. Trauma is another factor which frequently precipitates the cellular response.

I consider this neoplasm sufficiently rare at the present time to warrant a detailed report. In addition, a revised method of correcting the nasal deformity is described in detail.

CASE REPORT

H. G., aged forty, male, merchant by occupation, presented himself with the following history: Some twenty years previously, following a submucous resection, he sustained a falling of the bridge of the nose. About a month

* Presented before the Section in Otolaryngology of the New York Academy of Medicine, April 16, 1941.

after this accident, the same surgeon who had operated upon him injected paraffin to obliterate the disfigurement. The patient suffered no

A B

FIG. 1. A, front view before operation; B, profile before operation.

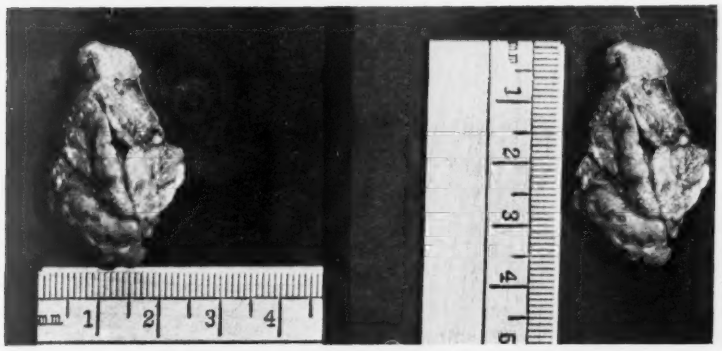

FIG. 2. Photograph of tumor removed.

immediate ill effects from the injection until about ten years ago, when he noticed a gradual tumefaction around the bridge of the nose which gradually grew until it reached its present size, about that of a hazel nut. Examination revealed a tumor of the bridge of the nose, extending from the tip to the root and also spreading laterally. It was markedly adherent to the skin, which presented a purplish and reddish appearance but showed no inflammatory reaction. At the center of the nose there was a slight protuberance the size of a small pea, which showed some tendency toward breaking down. (Fig. 1.) The blood Wassermann test was negative. On November 19, 1940, he was hospitalized, and under local anesthesia an incision 32 mm. in length was made extending from the root to almost the tip of the nose. Under careful dissection the tumor was removed; it weighed 4½ Gm., was 36 mm. long, 25 mm. wide at the center and 15 mm. thick. (Fig. 2.) The cut edges of the skin were sutured with fine silk material. The sutures were kept *in situ* for twenty-four hours and then removed. For the purpose of correcting the saddle nose deformity to be expected after the removal of the tumor, the standard technic employed for the purpose of narrowing the bridge of the nose was as follows:[5] Incisions were made at the extreme lower end of the pyriformis opening of both sides of the nose. The periosteum was freed from the bone, from the lower external end of the pyriformis opening to the radix nasi, and the bone sawed with a knee-shaped Joseph saw through the proc-

essus frontalis of the maxilla on both sides. The freed portions of the bones were pushed toward the median line for the purpose of narrowing the bridge of the nose. The fractured bone was then held in place by a lead splint for one week. Hunt[1] recommends that after removing the paraffinoma, the cavity be filled with areolar tissue; he also advises the removal of sections of the stretched skin.

A B

FIG. 3. A, front view after operation; B, profile after operation.

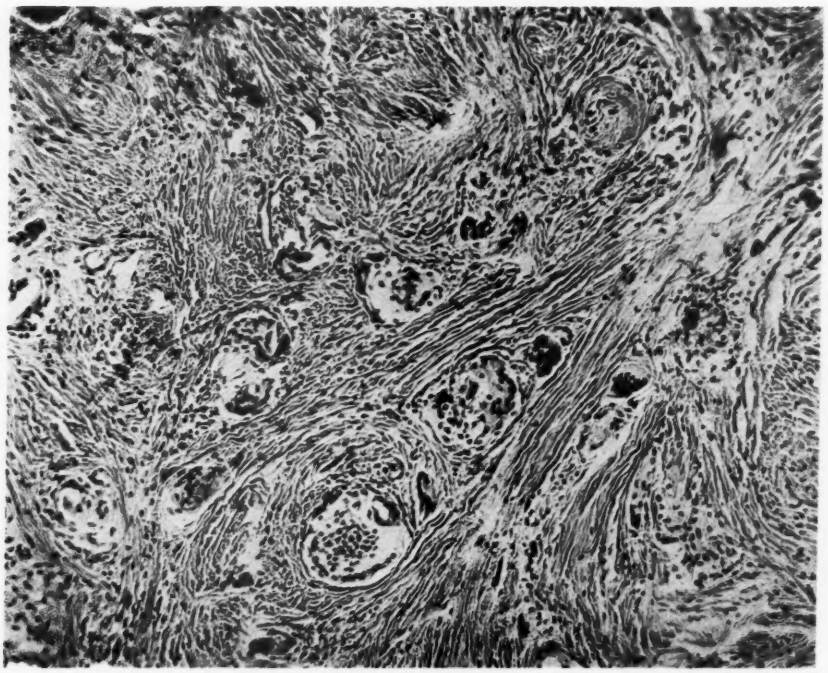

FIG. 4. Photomicrograph of specimen removed showing a mass of fibrous tissues in which there are innumerable foreign body giant cells containing and surrounding elongated and oval-shaped spaces.

My results in this case have been extremely gratifying. The patient was left with a barely noticeable thin linear scar and otherwise good

cosmetic results. This method is therefore recommended to the profession for the treatment of similar cases. (Fig. 3.)

The pathologic report was as follows: There are a mass of fibrous tissues in which there are innumerable foreign body giant cells containing and surrounding elongated and oval-shaped spaces. These clear spaces are also found in the scar tissue apart from the giant cells. *Diagnosis:* Foreign body granuloma, paraffinoma. (Fig. 4.)

SUMMARY

A case of paraffinoma of the nose is herewith presented. The literature is discussed and the methods employed for the removal of the neoplasm, and the correction of the deformity are described in detail.

REFERENCES

1. Hunt, H. L. Conclusions from one hundred cases of paraffinoma. *Med. Times*, 52: 145–148, 1924.
2. Ikeda, K. Lipoid pneumonia of the adult type (paraffinoma of the lung): report of five cases. *Arch. Path.*, 23: 470–492, 1937.
3. Davis, B. F. Paraffin cancer. *J. A. M. A.*, 62: 1716, 1914; Ibid: Paraffinoma, wax cancer. *J. A. M. A.*, 75: 1709, 1920.
4. Johnson, P. E. Paraffinoma of the knee. A case report. *West. J. Surg.*, 45: 331–333, 1937.
5. Wolf, G. D. Rhinoplasty: facts and fiction. *Arch. Otolaryngol.*, 11: 322–333, 1930; Ibid: Correction of saddle nose. *Arch. Otolaryngol.*, 22: 304–311, 1935.

The point is not always kept in mind that ordinary infections if local and well drained stimulate osteogenesis. This formation of bone in the vicinity of an infected fracture may be useful if all the parts are in correct position and if the wound is kept open so that deep abscesses are not enclosed in the healing bony or connective tissue scar.
From—"Wounds and Fractures"—by H. Winnett Orr (Charles C. Thomas).

INCARCERATED PELVIC KIDNEY EXHIBITING UNUSUAL FEATURES

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ALTHOUGH urologic literature abounds in cases of aberrant renal vessels, and many of these vessels

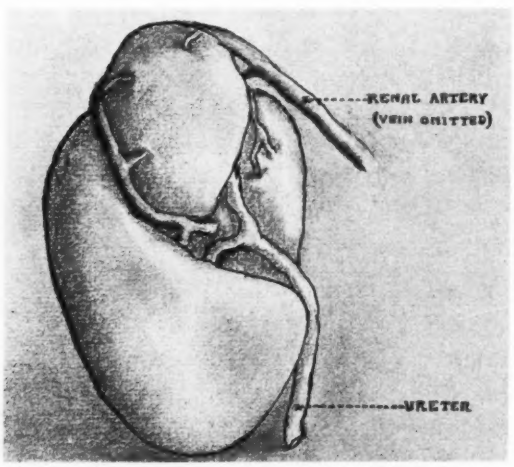

FIG. 1. Showing incarceration of kidney by surrounding vessels.

exhibit unusual courses to upper as well as to lower kidney poles, it is unusual for the main renal vessels to encircle the kidney. The accompanying drawing illustrates such a case which may have interest in this connection.

Another oft-stated dictum, that pain in ectopic kidneys is never present unless accompanied by pelvic dilatation or hydronephrosis, would also seem to be refuted by this same case, in that no dilatation was in evidence.

CASE REPORT

A young woman of twenty-six came to us with a complaint of persistent pain in the right lower portion of her abdomen, corresponding with a palpable tumor lying on the promontory of the sacrum, slightly to the right of the midline. The mass allowed of some lateral motion, but resisted longitudinal displacement, upward pressure against the tumor exaggerating her pain.

Because of the need for pelvic exploration also, a transperitoneal approach to the tumor was made, and a somewhat small kidney, incarcerated by encirclement of the upper pole by the main renal vessels, was found. Tension from the encircling vessels had caused rotation of the organ in all three planes, the pelvis facing forward, and the lower pole being disposed anteriorly and laterally. Since the ureter exhibited seemingly unused length and pain was the paramount symptom necessitating relief, it was thought that freeing the kidney from the incarcerating vessels and doing a nephropexy of some sort afforded the only chance of relieving the patient.

While attempting to slip the vessels out of the groove they occupied, and up over the upper pole, several small vessels which entered the kidney substance directly, were encountered. These were ligated, but two escaped and retracted, and caused considerable hemorrhage which could not be controlled by any of the usual methods.

The danger of perisitent postoperative hemorrhage, as well as fear of possibly too great encroachment upon the lumen of the main renal artery by the many ligatures required immediately adjacent to it, caused a nephrectomy to seem to be the part of wisdom, the other kidney being normal in position and function. The convalescence was uneventful, and the patient's pain was completely relieved.

On section the kidney showed apparently normal excretory units. The pelvis was definitely bifid in type, and there was no apparent dilatation of ureter, pelvis or calyces.

That the pain was due to the pull on the renal vessels with resultant compression and rotation of the kidney seems probable, at least in this case, as no dilatation, distention, or infection were demonstrable.

Encirclement of the entire upper renal pole by the main vessels has seldom been reported, if ever.

ACUTE MECHANICAL ILEAL OBSTRUCTION FOLLOWING APPENDECTOMY*

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AND

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INTESTINAL obstruction occurs not infrequently after appendectomy. When it ensues early it is usually the result of local or diffuse peritonitis and when it develops late it is most commonly due to bands and adhesions following peritonitis.

This report is concerned with a type of obstruction due to technical errors at the time of appendectomy. The unsuspecting surgeon may unconsciously contribute to this group if the anatomy is not carefully scrutinized when the mesentery of the appendix is ligated. If the ileum is inadvertently angulated during this step, an obstruction of varying degree may ensue. Subsequent to an otherwise routine operation, the convalescence is interrupted by symptoms of obstruction. The usual measures employed for the relief of postoperative pain, distention, vomiting and borborygmi fail. The denouement comes when the symptoms become so ominous that surgery again has to be resorted to for relief.

The following case reports illustrate obstruction secondary to angulation or kinking of the terminal ileum caused by technical errors in ligating the mesentery of the appendix.

CASE REPORTS

CASE I. Mrs. E. G., age thirty-seven, was admitted to Cook County Hospital July 16, 1939, for a vaginal plastic operation and correction of a pelvic disorder. Operation was done July 20, 1939, and included an appendectomy which was incidental to the laparotomy. There was no evidence of disease of the appendix. Convalescence appeared to be uneventful for three days. During the next four days it was noted that the abdomen became progressively distended, and this was followed by abdominal pain and borborygmi. Intestinal suction relieved the symptoms temporarily, but when discontinued there was recurrence of the distention and pain. The use of enemas and mineral oil failed to alleviate the condition. There was no elevation in temperature or pulse rate, and the satisfactory general condition of the patient was maintained by the use of intravenous dextrose and salt solutions. On the seventh postoperative day it was thought advisable to re-open the abdomen. Exploration revealed the cause of obstruction. Proximal to the ileocecal junction, the terminal ileum was fixed to the cecum at the site of the appendectomy. (Fig. 1.) A sharp angulation of the ileum occluded its lumen. This angulation was released by severing the attachment of the ileomesenteric fold to the site of the inverted stump of the appendix. The obstruction was overcome immediately and intestinal contents entered the cecum.

More frequently mechanical intestinal obstruction at the ileocecal portion of the intestinal canal occurs as a late sequel to appendectomy. The following case report illustrates this type:

CASE II. Mrs. A. W., age forty-one, entered Cook County Hospital July 14, 1940, with symptoms and findings of intestinal obstruction. A suprapubic midline scar represented an operation done one year before for removal of the uterus and tubes. An appendectomy was also done at that time. Intestinal decompression, enemas and intravenous fluids lessened the patient's distress, but mineral oil given by mouth failed to appear in the washings from the large bowel. On July 17, exploration of the

* From the Department of Surgery, Northwestern University Medical School, and the Cook County Hospital, Chicago, Illinois.

abdomen was done under spinal anesthesia. An obstruction of the ileum was found approximately 5 cm. from the ileocecal junction.

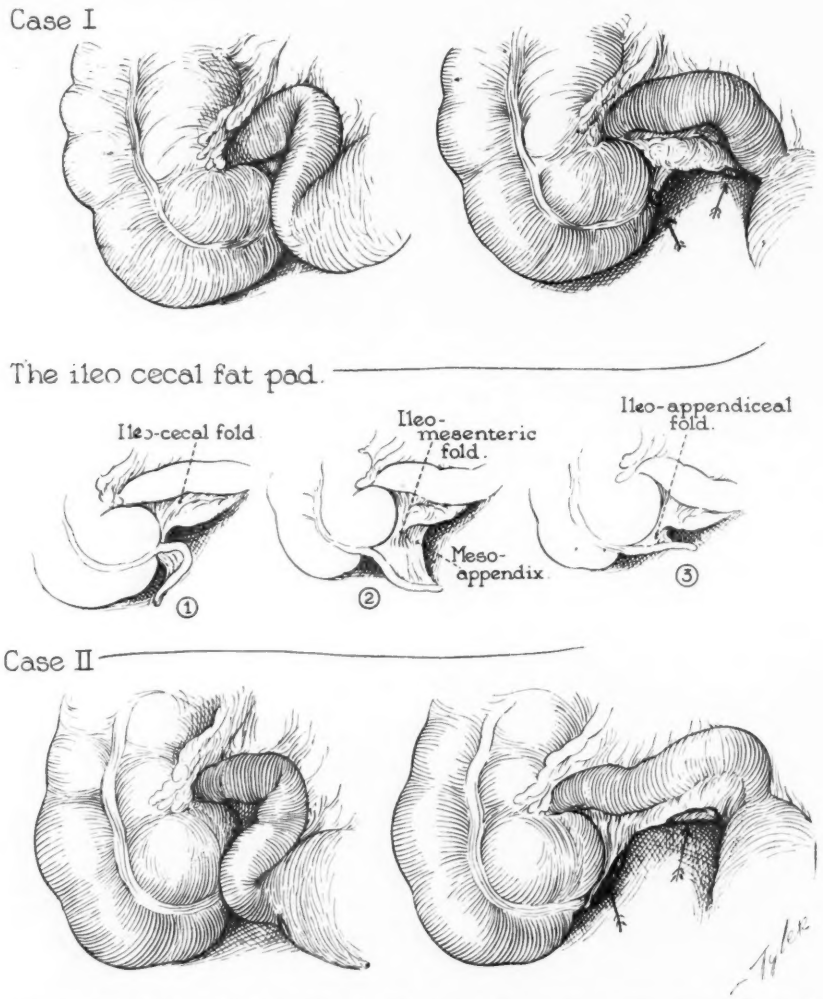

Fig. 1. The ileal pad of fat and its relationship to the cecum, appendix and meso-appendix. Case I and Case II showing fixation of ileal pad of fat to the cecum with kinking of the bowel. Arrows indicate site of release of obstructing peritoneal fold.

(Fig. 1.) What appeared to be the remaining portion of a short meso-appendix lying behind the ileum was fixed to the cecum at the site of the appendiceal stump. A sharp angulation of the ileum was present. Severance of the band released the ileum and the obstruction was promptly relieved as the intestinal contents freely entered the cecum.

DISCUSSION

The two cases cited above illustrate a hazard in appendectomy related to the meso-appendix, the ileocolic fold and the ileomesenteric fold. This complication may occur in those instances in which the meso-appendix is short. It may also take place when the ileomesenteric fold is inadvertently clamped and ligated with the meso-appendix. Anatomically, the ileal pad of fat is related to the cecum, appendix and meso-appendix. (Fig. 1.) The ileomesenteric and ileo-appendiceal folds appear to a greater or lesser extent when the appendix lies medial or inferior to the cecum. The retrocecal appendix and its mesentery usually are not fixed to the terminal ileum by the ileomesenteric fold. Wakeley,[1] in an analysis of the position of the appendix in 10,000 instances, found the retrocecal appendix to be present in 65 per cent of the

cases. Thus, in almost two-thirds of the cases fixation of the meso-appendix to the cecum will not alter the position of the terminal ileum to any extent. In the remaining one-third of the cases, however, this possibility exists. In the two cases cited, infection (appendicitis) was not present at the time of the primary operation.

CONCLUSIONS

1. Intestinal obstruction following appendectomy is possible as a result of angulation and fixation of the terminal ileum. This complication may occur soon after appendectomy (Case 1) or at a considerable time later (Case 11).

2. Ligation of the meso-appendix should not include the ileo-appendiceal or ileomesenteric fold. It is better to ligate individual vessels than to ligate a broad meso-appendix *en masse*. The mass ligation may include the ileal attachment and disturb the normal relation between the ileum and cecum.

3. After ligation of the vessels, the attachment of the meso-appendix to the cecum would appear to offer an unnecessary hazard. It probably had better be left undisturbed in its natural position.

REFERENCE

1. WAKELEY, C. P. G. The position of the vermiform appendix as ascertained by analysis of 10,000 cases. *M. Press*, 134: 141, 1932.

PRIMARY MELANOTIC SARCOMA OF OVARY

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PRIMARY melanotic sarcoma of the ovary is exceedingly rare. According to statistics of various authors it varies between 1 and 6.5 per cent as compared with other tumors of the ovary. Although the literature contains many reports of metastatic melanotic tumors of the ovary, a careful review of these reports discloses only six cases that have been classed as primary and these will be enumerated later. The text books devote very little space to this condition, due to its rarity, but the best review of this subject is to be found in Ewing's "Neoplastic Diseases."

He defines melanoma as a "pigmented tumor arising from a specific mesoblastic cell, the chromatophore; probably also from tactile cells lying in the epidermis and probably also from nerve cells in the derma." Ewing recognizes as common sources of melanomas, pigmented moles and naevi, the choroid, iris and ciliary body, the pia arachnoid, adrenals and colon. Among disputed points of origin of melanoma he lists the gallbladder, liver and spleen, but does not mention the ovary.

The histogenesis is summarized by Ewing as follows:

1. Exclusively from mesoblastic chromatophores. (Ribbert.)

2. Exclusively from epithelial cells and epithelial chromatophores. (Post, Wieting, Hamdie, Favara.)

3. From nerve cells in the skin, and mesoblastic chromatophores in choroid and meninges.

4. From endothelial cells of blood and lymph vessels or of nerve trunks.

5. From chromatophores, tactile corpuscles and nerve cells forming the end apparatus of cutaneous sensory nerves. (Mason.)

It seems to be an accepted fact, that it would not be possible to have a primary melanotic sarcoma of the ovary unless there was originally within the ovary a dermoid cyst or a teratoma in which was incorporated some epithelial elements containing melanin.

The six reported cases that are considered as primary melanotic sarcoma of the ovary are as follows: (1) Soubetran and Rives;[2] (2) Andrews;[3] (3) Wintervitz;[4] (4) Amann;[5] (5) Westenhaiffer;[6] (6) Bab.[7]

The case herein reported, I consider as primary. Sections from the growth were submitted to three competent pathologists all of whom concurred in the diagnosis and were of the opinion that the growth originated in teratomas. As further evidence of the growth being primary, is the fact that there is no evidence of any tumor or growth from which there could have been metastases.

CASE REPORT

Mrs. H. F. B., a white, married woman, age thirty-three, was admitted to Greenwood Leflore Hospital on January 25, 1941, with diagnosis of pelvic inflammatory disease with probable ovarian cyst, twisted on the pedicle. Her chief complaints were pelvic pain with palpable mass for the past six months, flooding, severe cramping pain, left lower quadrant for past 18 hours, not relieved by morphine. The family history was unimportant.

Menses began at thirteen years, and was of the twenty-eight-day type. It was regular until three years ago when she began flooding. She had been married twelve years and gave no history of any pregnancy. This patient was examined by me one year before at which time she complained of flooding. Examination at that time revealed a mass in each side of the pelvis, about the size of a small lemon; both masses were tender, the mass on the right side being fixed. Surgery was advised but refused.

The present illness began eighteen hours before admission with severe cramping pain in the left lower quadrant. Pain was colicky in type and was accompanied by painful urination. Patient had been nauseated and had vomited. She was seen by another doctor who gave morphine gr. ¼, but this failed to relieve the pain.

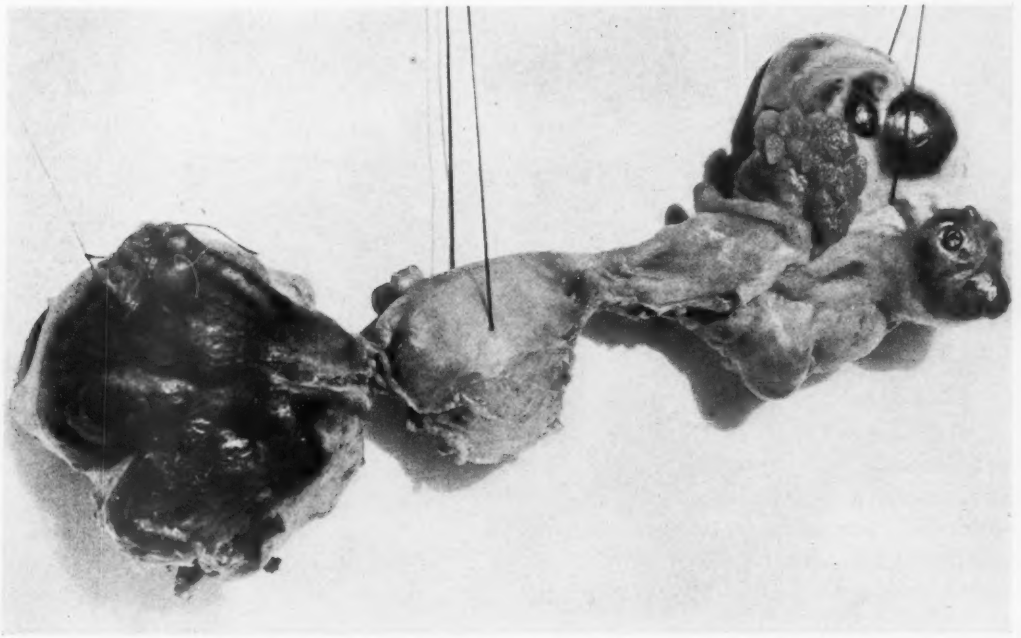

FIG. 1. Gross specimen of ovaries, tubes and uterus.

Physical examination revealed the patient to be 5 feet 6 inches tall, weighing 115 pounds. She was fairly well nourished and well developed. Facies was indicative of suffering. Temperature was 99.4°F., pulse 88, blood pressure 112/80, red blood count 4,080,000, hemoglobin 78 per cent, white blood count 10,240, small leucocytes 31 per cent, transitionals 5 per cent, polymorphonuclears 64 per cent. The chest was negative for any pathological condition and the heart regular, pulse 88, and no valvular heart disease.

The abdomen was rigid and exquisitely tender over the lower portion. In the lower left quadrant there was a mass palpable through the abdominal wall, irregular in outline and hard in consistency. The vagina was almost obliterated by the mass in the cul-de-sac, irregular in outline and firmly fixed.

A diagnosis was made of pelvic inflammatory disease with left ovarian cyst, twisted on its pedicle.

Under sodium amytal, ether, gas anesthesia, a midline incision was made. On the left side was found a tumor of the left ovary, bluish in color, firm to touch, nodular, approximately 10 cm. in diameter; there were no adhesions and it was twisted on its pedicle. On the right side, there was a tumor similar in size and shape to the one on the left, but firmly bound down in the cul-de-sac by adhesions. The right tumor was easily freed from its adhesions, and a bilateral salpingo-oophoroectomy, supravaginal hysterectomy was done. There were no other masses in the abdomen and no palpable glands or metastatic growths. There was no free blood or fluid in the peritoneal cavity.

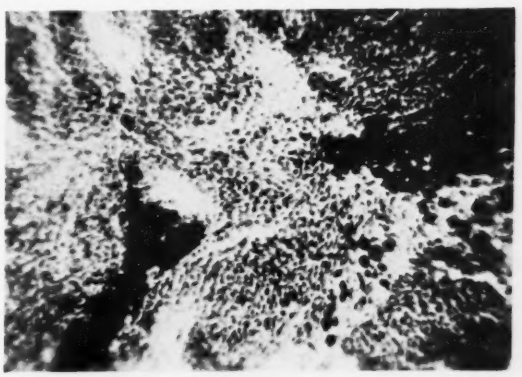

FIG. 2. Low power microphotograph of section of ovary.

The pathological report made by Dr. W. W. Robinson, follows: Section of tumor of the ovary is apparently well encapsulated, and approximately the size of a small orange. The

cut surface is meaty with much blackish pigment diffusely distributed throughout, as well as areas of hemorrhagic extravasation.

sists of a loose areolar connection tissue; there is injection of the blood supply as well as large areas of hemorrhagic extravasation.

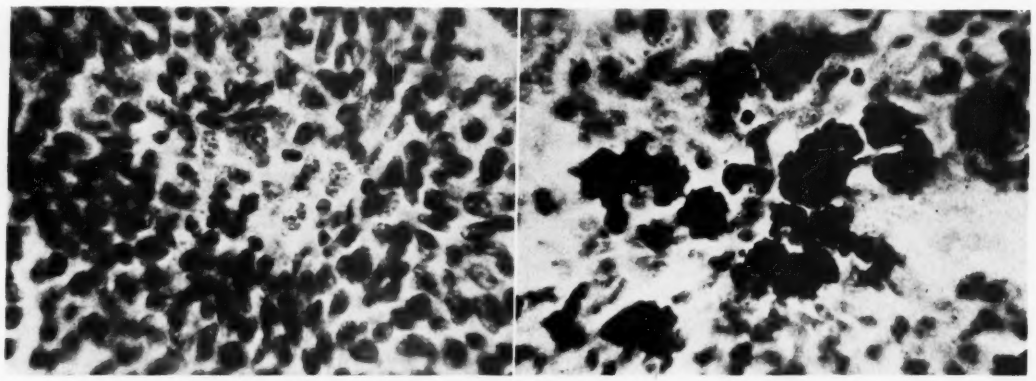

Fig. 3. Fig. 4.

Figs. 3 and 4. High power microphotographs of section of ovary.

Pathological report: Parenchyma: Plexiform or ramifying masses of poorly differentiated, highly anaplastic mesoblastic or mesenchymal cells simulating fibroblasts, and showing two to six mitoses to the high power field are present. There is variation in the size, shape and staining characteristics of the cells. Many of the cells contain a melanin-like pigment. There is also much of this pigment distributed between the neoplastic cells, incorporated in macrophages, and laid down in large and massive deposits. Areas of liquefaction necrosis of the growth are present. Some infiltration with round cells is noted.

There is much thickening of the tunica albuginea which apparently encapsulated the neoplastic process. Directly beneath the tunic, and arranged in strata throughout the fibrous capsule there is much melanin pigment deposit. The supportive structure of the growth con-

Pathological diagnosis: Typical melanotic sarcoma of ovary.

This patient made an uneventful recovery and was dismissed from the hospital on the fourteenth day. At this time, May 1, 1941, the patient is doing her housework, weighs more than she has in the past five years and so far has shown no evidence of any metastases.

REFERENCES

1. Ewing. Neoplastic Diseases. 3d. ed. Philadelphia, 1928. W. B. Saunders & Co.
2. Soubetran and Rives. *Arch. gén. de chir.*, 5: 1098–1108, 1911.
3. Andrews. Cited by Wintervitz.
4. Wintervitz. 1909. *Bull, Johns Hopkins Hosp.*, p. 314, 1909.
5. Amann. *Zentralbl. f. Gynäk.*, pp. 212–875, 1903.
6. Westenhaiffer. *Deutsche med. Wchnschr.*, May 1, 1902.
7. Bab. *Arch. f. Gynäk.*, 1906.

ADENOCARCINOMA OF THE RECTUM AND CHROMARGENTAFFINE TUMOR OF THE JEJUNUM*

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IN a review of the literature since 1930 we were unable to find any instance of adenocarcinoma of the rectum associated with chromargentaffine tumor of the jejunum. We deem it worthwhile to report this case.

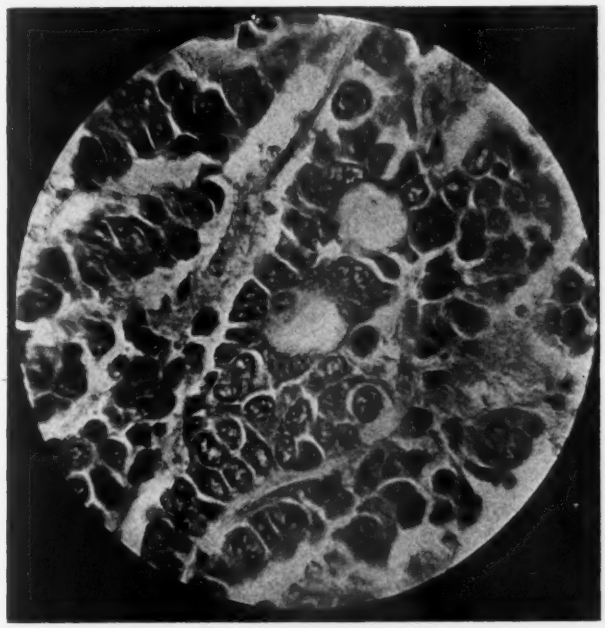

FIG. 1. Adenocarcinoma.

CASE REPORT

Mr. A. C., a forty-eight year old, married restaurant worker, entered the hospital on March 28, 1939, complaining of weakness and pain in the rectum. He was well until two months previous to admission when he experienced pain on defecation and his stools became covered with streaks of bright red blood. There was a weight loss of fifteen pounds and a moderate loss of strength since the onset. He had the usual childhood diseases. With the exception of chronic constipation which four years ago became more marked and required almost daily laxatives, the past history was essentially negative. The family history was irrelevant.

On physical examination, the positive findings were limited to the rectum, where a tender 3 cm. ulcerated mass was felt in the midline on the posterior wall 4 cm. proximal to the anus. The blood pressure was 160/90. The urine was essentially normal. Hemoglobin was 80 per cent (Tallqvist), red blood cells 4.2 million, and white blood cells 10.0 thousand with 76 per cent polymorphonuclear leucocytes. The Wassermann test was negative. Proctoscopic examination confirmed the physical findings. A biopsy taken at that time revealed the presence of adenocarcinoma, type II plus. Laparotomy, on April 3, 1939, disclosed a fixed rectal mass firmly adherent to the pelvic floor. There were two 3 cm. metastatic nodules within the liver. A palliative colostomy was done and he was discharged on the thirty-eighth hospital day.

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On June 20, he was readmitted because of excruciating rectal pain and was given a subarachnoid injection of alcohol in the fourth lumbar space.

FIG. 2. Jejunum with delicate villi and submucous clusters of chromargentaffine cells.

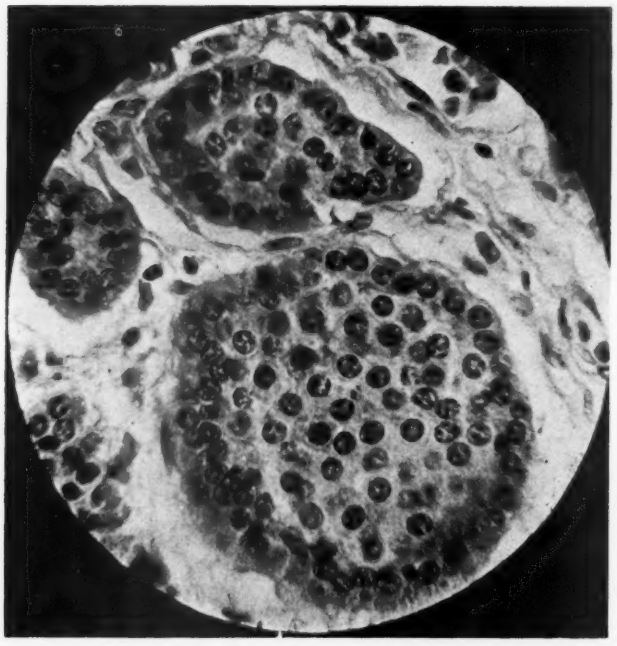

FIG. 3. Spheroidal cells with round nuclei, chromophobic cytoplasm and indistinct cellular membranes.

On August 6, the patient was admitted for a third time with severe perineal pain and another subarachnoid alcohol injection was given. He became progressively weaker and died with terminal pneumonia on August 14, five and one-half months after the onset of the first symptoms.

Complete postmortem examination was done two hours after death with the following findings: terminal pneumonia, adenocarcinoma of the rectum, chromargentaffine tumor of the jejunum and metastatic adenocarcinoma of the liver and adrenals. The entire posterior cul-de-sac was filled with a 5 cm. firm mass

adherent to each lateral wall of the pelvis and completely encircling the rectum. The serosa in this region was deep red and interrupted by areas of granular pink tissue. On opening the rectum, the mucosa was pink and friable over a 3 cm. ulcerated area which had firm, pink, granular, elevated margins. The base of the lesion was of firm white granular tissue which extended through the muscularis and serosa.

Within the jejunum, 30 cm. distal to the ligament of Treitz, was a 1.5 cm. round nodule projecting into and partially obstructing the lumen. The overlying mucosa was smooth. On section, the tumor was roughly spheroidal, yellowish and fairly well encapsulated. The muscular coat was intact and the serosa was smooth and glistening.

Microscopical pathological report: Sections of the rectum show erosion of the rectal mucosa. (Fig. 1.) The inflamed, partially necrotic submucosa is invaded by diffuse masses or clusters of closely related polygonal epithelial cells which have a fine granular acidophilic cytoplasm and oval nuclei moderately rich in chromatin. The nucleoli are conspicuous and there are many mitotic figures. The neoplasm has a moderate tendency to glandular formation. The muscularis and the serosa are similarly involved. Malignant emboli of the blood vessels and lymphatics are conspicuous.

Sections of the jejunum show flattening of the villi with conspicuous atrophy of the mucosa. (Fig. 2.) Within the submucosa (Fig. 3) there are masses of closely related polygonal cells which have finely granular, moderately chromophobic cytoplasm, indistinct cellular outline with conspicuous perinuclear membrane; the nuclei are moderately dotted with scanty chromatin material and occasionally have chromatic nucleoli. The tumor is limited by a layer of low cuboidal cells. There are no demonstrable mitotic figures. The stroma is a fibrous structure with a moderate amount of a collagen material. The tumor is limited from the muscularis by a dense fibrous capsule.

CONCLUSIONS

1. Adenocarcinoma and chromargentaffine tumor, two separate, unrelated neoplasms, occurring in the same patient represent a rare finding.

2. Chromargentaffine tumors are most commonly located within the submucosa of the appendix, small bowel, stomach and colon. They are usually benign but they may give symptoms of obstruction.

3. In performing a laparotomy intra-abdominal exploration is important, even though the anticipated pathological condition is found.

INFILTRATING SQUAMOUS CELL EPIDERMOID CARCINOMA INVOLVING THE OS CALCIS

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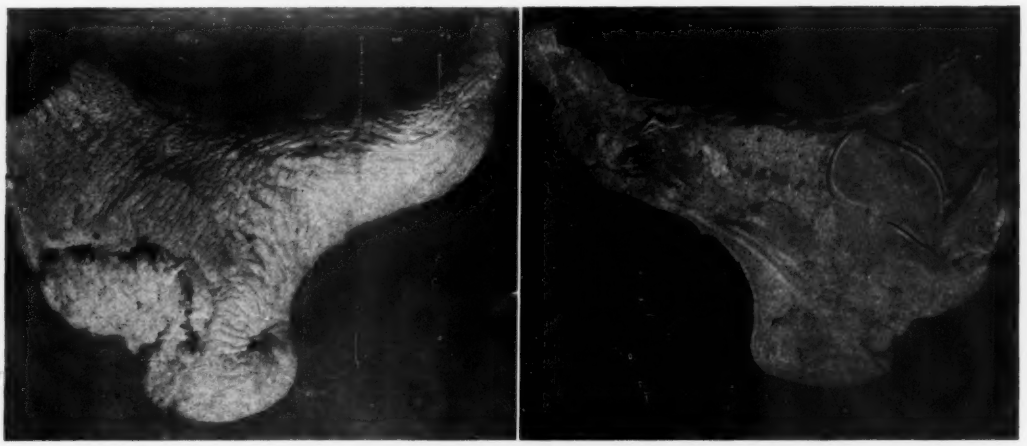
THIS case was selected for presentation because of the extremely rare occurrence of, first, the disease, namely, a squamous cell epidermoid type of carcinoma in a chronic osteomyelitic cavity and, secondly, because of its location—the os calcis.



A B

FIG. 1. A, photograph of gross specimen demonstrating extensive ulceration extending over the Tendo-Achillis. B, sagittal section of same specimen demonstrating destruction of the os calcis and obliteration of the calcaneoscaphoid joint with a fibrous ankylosis.

CASE REPORT

E. M., a white male, age thirty-four, a salesman, was admitted to the Hospital for Ruptured and Crippled on June 2, 1936, relating a history of a compound fracture to the left os calcis sustained in a crushing injury eighteen years previously in 1918. Subsequently, two years later a sequestrectomy was performed at another hospital, following which the wound closed and the patient was able to walk free from pain until March, 1936, when a sinus appeared, which later evolved into a deep ulcer at the back of the heel.

On June 10, 1936, an Orr treatment was performed, the os calcis was saucerized, old necrotic tissue excised, wound packed with vaseline gauze and plaster applied. The plaster was removed three months later on September 15, 1936, by popular request.

The wound, although much cleaner, never completely healed, and it was drained at intervals, followed by azochloramid dressings. In March, 1938, there appeared a crater like deformity posteriorly with much fibrosis of the overlying soft tissue.

In December, 1938, the wound appeared sufficiently clean to consider skin grafting, but the development of a bony exostosis from the os calcis, extending through the wound, prevented this procedure. Exostectomy was done December, 1938, at which time no sequestrum was found, and there was not much evidence of infection. The bone appeared sclerotic and eburnated.

The patient continued ambulatory, requiring only infrequent dressings, until March, 1939, when while riding in his car the foot began to bleed freely. He was re-admitted to the hospital and a pressure dressing was applied. The wound appeared not unlike a rodent ulcer, with a large open malodorous mass of greyish granulations fungating in appearance. Biopsy at this time revealed chronic suppurative inflammatory tissue with epithelium growing along a sinus tract. It was considered precancerous and had the appearance of a

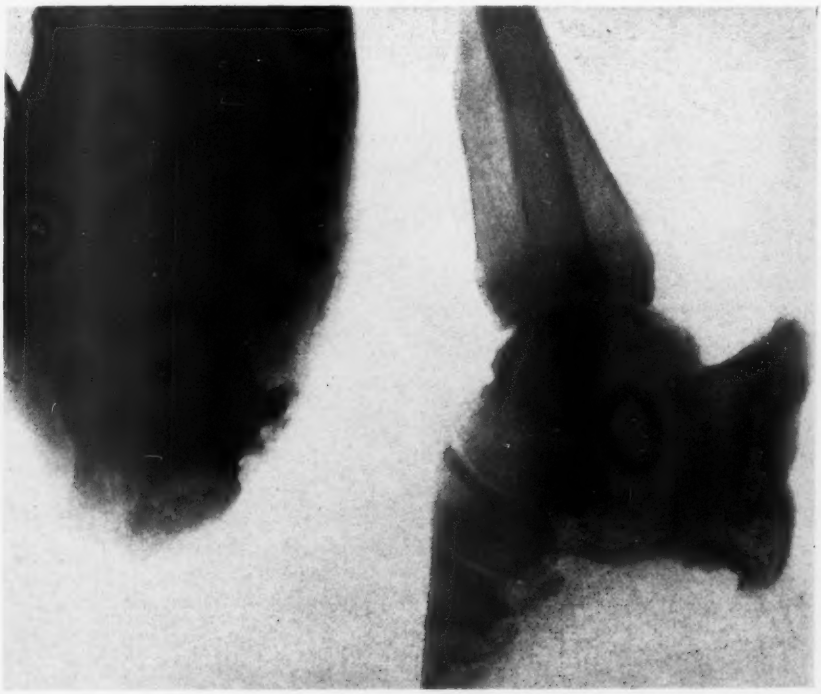


Fig. 2. Roentgenograms, taken September 14, 1937, showing an extensive old deformity involving the posterior half of the calcaneus with spurs on the medial side and some small sequestra. No large necrotic bodies are seen.

Fig. 3. Roentgenogram, taken April 24, 1939, after removal of most of the calcaneal tuberosity. The raw surface seems rough and moth eaten in appearance and is blurred by soft tissue swelling. A number of densities suggestive of dead bone may be seen.

fungus infection. Repeated cultures on special media for fungus were negative. The patient continued to take a retrograde course with a

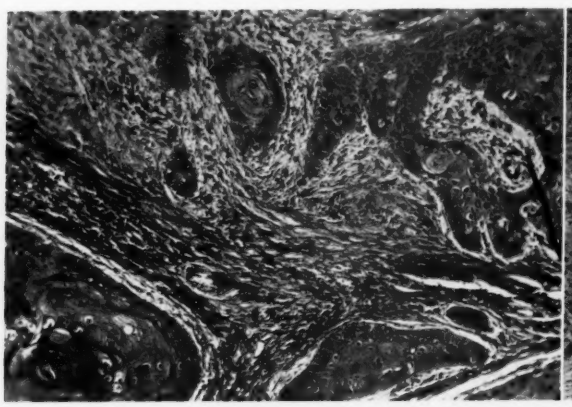


FIG. 4. Photomicrograph of a section taken from a block of the soft pulpaceous material which replaced most of the os calcis, showing a loose fibrous stroma richly infiltrated with histiocytes. × 120.

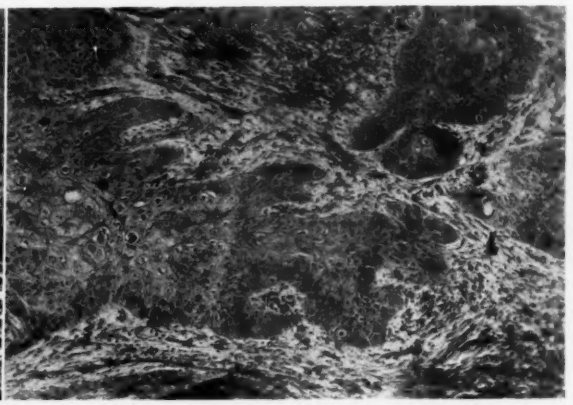


FIG. 5. Photomicrograph demonstrating bizarre overgrowth of stratified squamous epithelium with occasional mitotic figures. × 120.

temperature varying between 101 and 102°F. so that amputation at the midshaft of the tibia was performed on May 9, 1939.

The pathological specimen revealed multiple abscesses with destruction of the posterior two-thirds of the os calcis, being replaced by a pulpaceous yellow mass of gritty, friable consistency.

Histological section showed a bizarre overgrowth of stratified squamous epithelium with occasional mitotic figures. This section was taken from a block of the soft pulpaceous material which replaced most of the os calcis. It showed an overgrowth of stratified squamous epithelium, made up of atypical cells which are large, irregular, with prominent nuclei with occasional mitotic figures. There was a great deal of necrosis of the tumor and there was a loose fibrous stroma which was richly infiltrated with inflammatory histiocytes. *Diagnosis:* Infiltrating squamous cell epidermoid carcinoma.

The prognosis of this disease is very favorable though histologically malignant clinically, it runs a relatively benign course.

As a result of the treatment in this case and because of the relatively short duration of the condition, amputation most likely will preclude recurrence. However, the possibility of its appearance in any case of long standing osteomyelitis should be borne in mind.

REFERENCES

BENEDICT, EDWARD B. Carcinoma in osteomyelitis. *Surg., Gynec. & Obst.*, 53: 1–11, 1931.

BLANCO, PIO. Squamous-cell epithelioma originating in chronic osteomyelitic cavities, reporting two cases. *Am. J. Cancer*, 19: 373–378, 1933.

BRUNSCHWIG, ALEXANDER. Epithelization of bone cavities and calcification of fibrous marrow in chronic pyogenic osteomyelitis. *Surg., Gynec. & Obst.*, 52: 759, 1931.

HARRISON, J. H. Epidermoid carcinoma in osteomyelitis; case report. *Am. J. Cancer*, 32: 527, 1938.

INTESTINAL PERFORATION FROM INGESTED FISHBONE

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MOST of the edible fishes are quite bony. Although in most varieties segmentation of body structure greatly facilitates their recognition and removal after cooking, many bones are swallowed. Careless eating, particularly in children, insensitive denture plates, poor vision, mental infirmity and drug addiction often are contributing factors.

The long bones of fishes differ from those of birds and of animals in that they vary little in size from base to tip. They are of fine texture with both ends sharp and with length out of proportion to circumference. The small mineral content permits a flexibility not possessed by other bones. Thread-like in outline, offering no contrast in color and giving but little sense of resistance in mastication, even when due care is taken in eating, they are unwittingly swallowed.

Ordinary cooking has but little effect upon the integrity or the penetrating qualities of fishbone for in frying, roasting or boiling a temperature of 212°F. is maintained only for a short time. In commercial canning,[3] however, fish are subjected to a much higher temperature (260°F.) for an hour or more. This, through an obscure chemical change, causes partial disintegration of bone so that it becomes soft and friable.

The fate of ingested fishbone on entering the stomach depends upon the duration of its stay and upon the degree of acidity encountered. In cases of low acidity it is but little effected by the process of digestion; but if the gastric secretion is highly acid, the organic matrix is digested and the inorganic mineral content dissolved. Knud Faber[2] found bones in the stools of twelve patients having achlorhydria after they had eaten fish and no bones in the stools of those having normal gastric digestion. In most people small bones are made harmless by digestion before reaching the intestine. Handles of pearl and of bone have been found to have been digested from pocket knives retained in the stomach of a professional swallower or human ostrich.

The likelihood of perforation by fishbone that reaches the intestine undigested is lessened by its ability, being flexible, to conform to the changing intestinal peristaltic pattern, although Armitage[11] found at a single operation three widely separated perforations of the small intestine, each marked by a partly protruding fishbone. It is remarkable that ingested needles, pins, spicules of glass and other sharp-pointed foreign bodies becoming incorporated in fecal masses, as a rule, pass without causing symptoms. Of 800 cases of ingested foreign bodies of all kinds seen at the Boston City Hospital only 1 per cent caused perforation.[2]

We can only guess at the percentage of ingested fishbones that perforate for there is no way of knowing how many bones are swallowed and a perforation, as in one of our cases, may heal spontaneously without being suspected. Except in infants, fishbone is the most frequently ingested foreign body. If the very few cases of intestinal perforation reported in the literature are compared to the tons of fish eaten daily by civilized people, the incidence of perforation must indeed be small.

The ultimate disposition of a fishbone after perforation varies. In most cases it passes from the lumen of the intestine through the perforation into the peritoneal cavity. It is possible, however, even after a sharp end has perforated the intestine several times, for the bone to remain in the lumen and be discharged by the anus. Small perforations of the intestine cause no eversion of the mucosa and heal spontane-

ously without reaction as do those made by individual birdshot in shotgun wounds of the abdomen.[15] A bone extruded from the intestine may migrate. An ingested fishbone has been found in an abscess of the liver.[14] A fishbone was found by us lying free on the anterior surface of the great omentum. Wood[10] reports a case of spontaneous recovery after the removal of a fishbone which, after perforation, had passed through the anterior abdominal wall and pierced the skin, and David[16] reports a case of long continued indigestion, pain and bladder irritation which was relieved by the passage of an ingested fishbone through the urinary meatus.

When localization of infection occurs after perforation, the bone is apt to be contained in the resulting abscess or to become incorporated in the chronic inflammatory mass which so often forms. Psoas pyogenic abscess of unexplained origin may be from this cause. In distinction from cases of acute perforation, from complicating pathological conditions and persistent symptoms, these are cases of so-called chronic perforation, and most perforations from foreign bodies are in this sense chronic.

Fish is such a common article of food that the history of having eaten it before the onset of symptoms is not of much significance in diagnosis. Diagnosis can be made only at operation or at autopsy. Most of the patients with acute perforation are operated upon for appendicitis. An ingested fishbone is too small to be shown by *x*-ray.

Symptoms vary with the site and the size of perforation for these are factors which largely determine the ability of the patient to overcome or to localize the resulting peritoneal infection. It is possible for fatal peritonitis to develop after perforation particularly in patients with low resistance. Symptoms also vary with the portion or segment of intestine involved. In the duodenum or stomach, if there is gross soiling, the abdominal rigidity of acutely perforating peptic ulcer may occur; in the small intestine there is apt to be pain followed by tympanites as in perforating diverticulitis; in the colon the symptoms are those of perforating appendicitis or diverticulitis. Fortunately, as a rule, the perforation is small and at a site favorable for localization. In these cases spontaneous recovery may take place, an abscess may form or the inflammation may become chronic without abscess. Stone[13] reports a case of resection of the stomach for cancer in which the condition proved to be an inflammatory mass containing a fishbone which had passed through the stomach wall. Inflammatory masses about the colon from this cause may readily be confused with chronic diverticulitis or malignancy.

Hemorrhage either into the intestinal lumen or elsewhere is rare although, according to Bearse,[12] a case has been reported of fatal gastric hemorrhage caused by a fishbone perforating the posterior stomach wall and a fishbone has been found in the superior mesenteric vein. In our case, in which a fishbone was found with one end in the internal iliac vein and the other in the lumen of an adherent loop of terminal ileum, there was no evidence of bleeding found at autopsy.

Henderson and Gaston,[2] in a comprehensive study of gastrointestinal perforation from ingested foreign bodies, report nine cases with two deaths in the Boston City Hospital, none of which was from fishbone. In sixty-two cases of perforation collected by them from the literature eleven of the patients died, (25 per cent); of the five cases in which the perforation was from ingested fishbone with one death (20 per cent), all were complicated by abscess. The locations were the stomach, the pylorus, the hepatic duct, and the splenic and sigmoid flexures of the colon. In neither series was there an acute perforation by fishbone. In our series of five cases all have been acute perforations with one death on the fifth day after admission from septicemia following perforation of the ileum and penetration of the bone into the right iliac vein. It was the only patient

not operated upon. In two cases Meckel's diverticulum was the site of perforation. In one the appendix was the probable site although the bone was found free in the peritoneal cavity. In one the site was undetermined for no evidence of inflammation or trauma could be found anywhere.

The treatment of intestinal perforation from any cause is entirely surgical. Even at laparotomy, however, the offending fishbone may not be identified and the true nature of the lesion be unsuspected. In no case, noted by us, of abscess or chronic inflammatory mass containing a fishbone has the perforation of the intestine been found, in no case has it been closed and in no case has fecal fistula resulted. It is of interest to note that Siddons,[1] in a study of 126 patients with foreign bodies admitted into three large London hospitals, advises that ordinary diet, without laxatives, be given after ingestion. Bulky foods, if the bodies are large, encourage obstruction and do no good even in the case of sharp objects.

CASE REPORTS

Case I. A negro woman, J. F., forty-six years old, without history of previous trouble, entered the Good Samaritan Hospital for relief of pain about the navel of four days' duration. The temperature and blood count were normal. At laparotomy a fishbone one inch long was found lying free on the outer surface of the great omentum. No evidence of trauma or inflammation was found. Spontaneous recovery had taken place.

Case II. (Case of Dr. LeGrand Guerry.) Mrs. C., white, age twenty-three, on admission to the hospital had a temperature of 101°F., blood cells 8,900, polymorphonuclears 75 per cent. She had complained of epigastric pain for two days with no previous attacks. She was operated upon for acute appendicitis. Subacute catarrhal appendicitis was found. A fishbone one inch long was lying free in the peritoneal cavity. The site of the perforation could not be determined. Recovery followed appendectomy.

Case III. H. F., a white man, age fifty, entered Providence Hospital with the diagnosis of acute appendicitis. Two days previously he had sudden pain in the lower portion of the abdomen without nausea. There was tenderness and rigidity over McBurney's point. He had a chill with temperature of 99.5°F. which rose the day after operation to 103°F., white blood cells 9,650, polymorphonuclears 62 per cent. At operation there was a fishbone protruding from the end of Meckel's diverticulum. Both the appendix and the diverticulum were removed and the patient recovered.

Case IV. G. W. W., a white male, aged forty, entered Columbia Hospital with the diagnosis of acute appendicitis. The onset was with pain in the abdomen six or eight hours previously. The white blood cells were 10,200 with 81 per cent polymorphonuclears. At operation acute diverticulitis was found with a perforating fishbone three-fourths inch long protruding from the diverticulum. The appendix and the diverticulum were removed and complete recovery followed.

Case V. A white man, aged forty-eight, entered the Columbia Hospital November 19, 1933. He had once been a patient in the South Carolina State Hospital for the Insane. He had complained of pain for several days in the right lower quadrant which radiated down the thigh. On physical examination there was rigidity and tenderness over the right lower portion of the abdomen but there was no distention. There were 10,000 white blood cells, 88 per cent polymorphonuclears, with no malaria. The urine was normal. The temperature was 102°F. on admission and reached 106°F. several times, each preceded by a chill, before he died unoperated upon on the fifth day after admission. There was mild jaundice.

Autopsy by Dr. Plowden revealed miliary abscesses throughout both lungs. A sharply angulated loop of ileum was found adherent to the right iliac vein with an opening into the intestine communicating with an opening into the vein and extending through both openings was a fishbone of small caliber, one and one-fourth inches long with both ends sharp and pointed. The cause of death was blood stream infection with multiple pulmonary abscesses resulting from perforation of the intestine and right internal iliac vein by a fishbone.

SUMMARY

We report five cases of acute perforation of the intestine by ingested fishbone in

each of which the bone has been found within the abdomen.

The site of perforation in two cases was a Meckel's diverticulum, in one case probably the appendix. The incidence of perforation in these blind segments is explained by their inability to rid themselves of the offending bone. Once it has entered, peristalsis forces it onward.

Cases I and II prove that when a perforating fishbone of small caliber is completely extruded from the intestine or falls back into the lumen so that the bone no longer pierces the wall of the intestine, the lesion made by it tends to close spontaneously without leakage, without peritonitis and without trauma of sufficient degree to mark the site.

An extruded fishbone tends to migrate and may cause an abscess far removed from the site of perforation.

Case V is unusual in that penetration of the internal iliac vein by the perforating bone was followed by fatal blood stream infection.

REFERENCES

1. Siddons, A. M. H. The fate of swallowed foreign bodies. *J. A. M. A.*, 113: 17, 1577, 1939.
2. Henderson and Gaston. Ingested foreign body in the gastrointestinal tract. *Arch. Surg.*, 36: 66, 1938.
3. Feaster, J. F. Research Dept. Am. Can Co. Personal communication.
4. Piquard and Grenet. Perforation of an ileal diverticulum by a fishbone. *Bull. et mém. Soc. anat. de Paris*, 2: 390, 1900.
5. Bruning, F. Perforation of the large intestine by a fishbone. *Zentralbl. f. Chir.*, 53: 1563–1564, 1926.
6. Watson, F. S. Perforation of the stomach and intestine by foreign bodies that have been swallowed. *Boston M. & S. J.*, 172: 622–625, 1915.
7. Thawkyard and Armitage. Peritonitis due to perforation of the bowel by foreign bodies. *Brit. M. J.*, 3665: 577–578, 1931.
8. Hagler and Stewart. Acute perforation of Meckel's diverticulum by fishbone. *J. A. M. A.*, 74: 1377, 1920.
9. Fry, W. Fishbone perforating the coecum. *Virginia M. Monthly*, 66: 173, 1939.
10. Wood, W. A. Fishbone extruding through the abdomen. *Intercolon. M. J. Australasia*, 9: 24, 1904.
11. Armitage, G. Three perforations of the ileum by fishbone. *Brit. M. J.*, 1: 307, 1938.
12. Bearse, C. Fishbones as a cause of intestinal perforation. *New England J. Med.*, 201: 885, 1929.
13. Stone and Owings. Perforation of stomach by a fishbone. *Am. J. Surg.*, 25: 180, 1934.
14. Wilheim, E. Hepatic Abscess Caused by Fishbone, *Zerb für Chirurgie*, July, 1925. Gen. Surg. 1926, 490. Year Book Publishers.
15. Bunch, Geo. H. Treatment of shotgun wounds of abdomen. *Tr. South. S. A.*, 41: 38–41, 1928.
16. David, I. An errant fishbone. *Brit. M. J.*, 1: 166, 1918.

STRUMA OVARII*

CASE REPORT

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AND

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THE unexpected histological report that a large ovarian tumor consists almost entirely of thyroid tissue is always startling. Similar findings have been sporadically reported.[1,2,3] Emge,[4] in 1940, reported on the functional and growth characteristics of such tumors and brought the literature up to date, adding two cases to the some 150 cases previously reported. The relative rarity of the tumor warrants the report of this additional case.

The essential features presented in this instance are that of a large, unilateral, asymptomatic, ovarian mass which made itself known only by reason of regional pressure. Histologically, the tumor mass, which measured 14 by 8 cm. consisted entirely of thyroid tissue, the ovary itself being compressed and distorted. The slight ascites noted at operation recalls similar findings in the other ovarian tumors (Meig's Syndrome).[5] There were no constitutional changes noted in the patient preoperatively so metabolic studies had not been done. The basal metabolic rate determination four weeks postoperatively was minus 4.

CASE REPORT

B. I., a fifty-seven year old married housewife, entered the hospital on March 30, 1941, complaining of vague abdominal pains of many years' duration. The family history was unessential. Past history revealed that she had undergone a uterine suspension and appendectomy in 1913; in 1930 a cholecystectomy had been performed, followed by a second laparotomy for adhesions.

The patient was married twice, had two living children and had had no abortions. She had menstruated regularly since the menarche, the menses occurring uneventfully save for mild pains before the flow. In 1932, at the age of forty-eight, a normal menopause occurred with no subsequent bleeding. She had been followed in the out-patient clinic since 1928 and several pelvic examinations were negative except for a third degree rectocele, so it would appear that the tumor developed to its present size late in life.

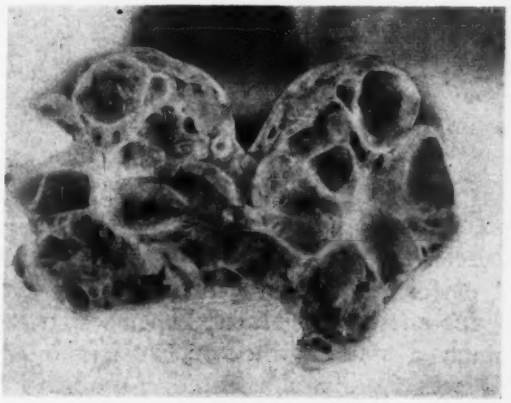

FIG. 1. Cross section of the tumor photographed after fixation and removal of sections for microscopic study.

The physical examination revealed an obese, middle-aged woman in no distress. Temperature was 37, pulse 80, respirations 22, and blood pressure 170/90. Her skin was white and clear. The pupils were equal and responded to light and accommodation. The heart was normal in size. Rhythm was regular and sounds were clear but distant. There was a loud blowing, harsh, aortic systolic murmur. Lungs were clear save for a few crackles at the bases. The abdomen was obese and protuberant. There were two surgical scars, one in the right upper quadrant and one in the midline below the umbilicus. Pelvic examination revealed a left adnexal mass slightly tender and fixed, about 8 by 14 cm. There was a first degree cystocele and rectocele. External

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hemorrhoids were noted. The remainder of the physical examination was essentially negative.

The preoperative diagnosis was left adnexal mass, probably cystic ovary, and third degree rectocele. The operation by one of us (A. L. B.) was performed March 31, 1941 under cyclopropane anesthesia. The abdomen was entered through a midline incision. A left ovarian mass was readily enucleated. Ascites to the extent of 400 cc. of clear yellow fluid was present. The remainder of the pelvic viscera appeared normal. Perineorrhaphy was performed.

The patient made an uneventful recovery, the wound healing per primum, and she was dismissed on the twelfth postoperative day. Subsequent metabolic studies were normal. (Basal metabolic rate one month postoperatively −4.)

The pathological report was as follows: Gross: Specimen consists of a firm, nodular, pearly grey, completely encapsulated mass to which a segment of tube is attached, the main mass measuring 14 by 8 by 6.5 cm. Microscopic: Sections show the ovarian parenchyma in places to be compressed and distorted. Very little ovarian tissue is present and no follicles are seen. Sharply demarcated from the ovarian tissue are areas of thyroid tissue. The latter is composed of acini of various sizes and shapes; some are small and compact with tall columnar epithelium. Varying amounts of colloid are contained in the acini. There is a variable amount of interstitial fibrous tissue. Large areas of replacement by loose connective tissue are seen in the thyroid tissue. In the ovarian stroma adjacent to the thyroid tissues are seen some clusters of lutein cells. There is no evidence of malignancy. Sections through the tube show slightly thickened villi, but the walls are normal.

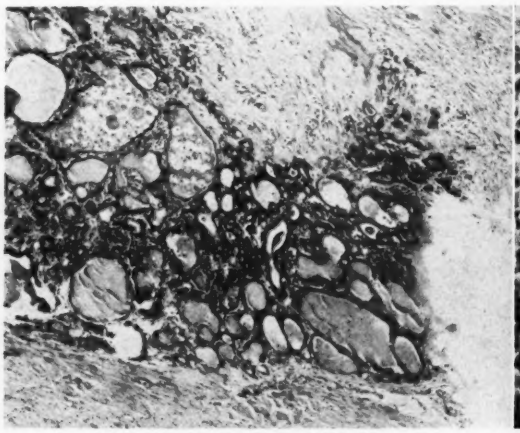

Fig. 2. Photomicrograph showing typical thyroid acini filled with colloid.

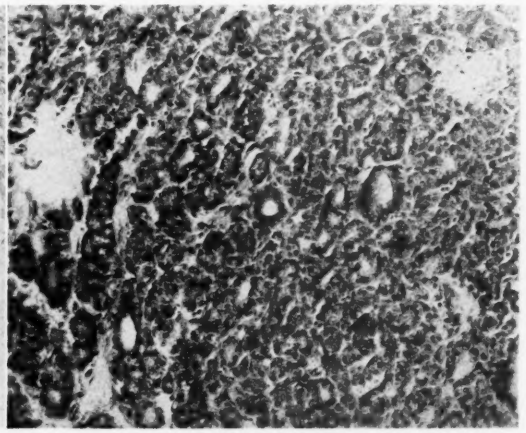

Fig. 3. Further portion showing thyroid without colloid.

REFERENCES

1. Nicholson, G. W. *Guy's Hosp. Rep.*, 87: 391, 1937.
2. Moench, G. L. *Surg., Gynec. & Obst.*, 49: 150, 1929.
3. Wynne, H. M. N. et al. *Am. J. Obst. & Gynec.*, 39: 263, 1940.
4. Emge, L. A. *Am. J. Obst. & Gynec.*, 40: 738–750, 1940.
5. Harris, F. I. and Meyer, M. *Surgery*, 9: 87–93, 1941.

LARGE OVARIAN CYST IN NEWBORN CHILD*

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THE ovary is the most frequent site of cyst formation in the body. Pathologically, ovarian cysts appear to be the result of inflammation, retention or degeneration, the changes taking place after a certain developmental stage and indicating some degree of maturity. More rarely these cysts grow as true tumors or cystadenomas and may occur at all ages. A search of the recent literature reveals that the presence of such cystic tumors in the newborn is extremely rare. Issacs and Schwartz[1] reported a case of twisted ovarian cyst in a girl three years of age. Likewise, Delthil[2] reported torsion of an ovarian cyst in a child twenty-six months old. The case herein presented concerns an infant who at birth showed evidences of an abdominal tumor that proved to be an ovarian cyst at operation thirty-six days later.

CASE REPORT

J. K., a female, was born at 3:59 A.M. on January 23, 1941 at the Shamokin Hospital following a normal delivery. While the cord was being severed, marked abdominal distention was noted. An *x*-ray examination on January 24, 1941 was reported as follows: "There is an apparent neoplasm of the abdomen displacing the intestines to the left side of the abdomen." No masses were felt. The abdomen was soft. The percussion note was dull on the right side of the abdomen while the left side was tympanitic. Rectal examination disclosed nothing significant. The child did fairly well, except for occasional vomiting after meals and constipation. Castor oil and colonic irrigations were used and, although not too effectual, did afford some relief. On February 2, 1941, another *x*-ray showed "an apparent increase in the size of the suspected mass." The child was allowed to go home and the mother instructed to return with her in two weeks.

Examination on February 24, 1941 revealed a well nourished child of good color. There was no change in the appearance of the genital organs. There was marked distention and asymmetry of the abdomen, the right side being much more enlarged than the left side. No masses were palpable. The abdomen was soft but had a peculiar doughy consistency on the right side. There was dullness over the entire abdomen. Rectal examination was negative. The mother stated the child had maintained her weight. The appetite was good but shortly after each feeding she vomited. The bowels were constipated. She slept a great deal, except for spells in which she cried vehemently as though she "were having colic." *X*-ray examination at this time revealed "A definite enlargement of the abdomen since the previous examination; apparently caused by a tumor in the right lower quadrant." The child was admitted for further study. Three days later subcutaneous urography disclosed "excellent secretion from both kidneys with no evidence of abnormality or obstruction on either side." A cyst, either mesenteric or ovarian in origin, was suspected.

On March 1, 1941, exploratory laparotomy was performed. Through a right rectus incision, a large soft mass was encountered, bluish in color, extremely thin-walled and occupying the entire abdominal cavity. Exploratory needling revealed the presence of straw-colored fluid. The size of the cyst made removal *in toto* impossible so that the contents were emptied with a trochar. The cyst was found attached to a long pedicle that arose from the left ovary. Oophorectomy was accordingly performed. Another small cyst, about the size of an orange seed, was removed from the right ovary. The remaining abdominal organs were normal. The abdomen was closed in layers without drainage. The child had an uneventful recovery and was discharged from the hospital in fourteen days.

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† Dr. Bulfamonte is now stationed at Fort Wm. McKinley, Rizal, P. I.

The pathological report was as follows: "The specimen consisted of a large ovoid cyst measuring 15 cm. × 13 cm. It had paper thin walls and was partly filled with straw colored fluid. The inner surface of the cyst was smooth, except for two small pea-shaped projections. Microscopically, the cyst was lined with flattened cuboidal cells. There were some glands in the coat of the thickened portion." Diagnosis: Cystadenoma of ovary.

COMMENT

The case presents many points of interest. Ovarian cysts in infants and young children, unless of sufficient size to produce abdominal enlargement, usually attract attention by becoming twisted upon them selves and giving rise to an acute abdominal condition. In this case, although the cyst was from the left ovary, a long pedicle accounted for the enlargement of the right side of the abdomen, demonstrating the ease of torsion. The presence of a small cyst on the right ovary indicated the possibility of bilateral or multiple cysts at an early age. The abdominal distention at birth and the *x*-ray findings strongly suggest the cyst had reached considerable size *in utero*. No explanation is available for the occurrence of such tumors in the newborn except unrestrained physiologic growth.

REFERENCES

1. Issacs, Harry E. and Schwartz, Albert M. Twisted ovarian cyst in a three year old child. *Am. J. Surg.*, 41: 298, 1938.
2. Delthil, P. Torsion of a dermoid cyst of the ovary simulating appendicitis in a child twenty-six months old. *Bull. soc. de pediat. de Paris*, 35: 69, 1937.

New Instruments

A NEW GASTROINTESTINAL SUCTION-IRRIGATION DEVICE*

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THE brilliant work of Wangensteen has established beyond any doubt the value of continuous suction-siphonage in the treatment of certain types of gastrointestinal distention. Having observed for some time the operation of the standard Wangensteen apparatus, it was seen to have a few minor drawbacks. In the first place, the set-up is somewhat unwieldy and occupies too much space at the bedside. Secondly, the duration of its action is relatively short and, consequently, it requires frequent and laborious attention to keep it in proper operation.

In the third place, it provides no adequate means of irrigation or flushing of the tube and bowel. This is a serious disadvantage, for the material in the bowel often needs greater dilution or emulsification in order to prevent clogging of the holes of the Miller-Abbott or Levine tubes.

Finally, the actual appearance of the Wangensteen apparatus and the constant manipulation and bottle changing required must be a source of considerable apprehension on the patient's part. It was with these various disadvantages in mind that a more compact, longer acting and more efficient type of apparatus was conceived which would combine both suction and irrigation.

As may be seen in Figure 1, this device consists of three glass bottles. Two of them, A and B, are used to store partial vacuum. They are joined to each other by means of a one-quarter inch copper tubing and two-holed rubber stoppers, in the manner illustrated. They are evacuated simply by connecting them at I to a faucet water-suction pump or aspirator such as may be found in almost every hospital, either in its laboratories or operating rooms.

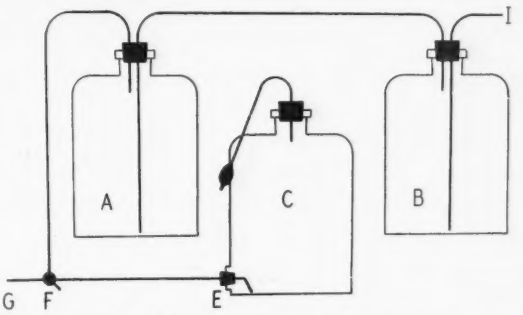

FIG. 1. Blaisdell gastrointestinal suction-irrigation device.

The third bottle, C, has an outlet at its bottom in addition to the one at the top. To the latter is attached a rubber bulb pump of the type used with a sphygmomanometer. (A small bicycle pump might do as well.) The rubber stopper in the mouth of the bottle should be wired and bolted on in such a way that it can easily be removed at will by unscrewing a wing nut, but will not blow off when the pressure within the bottle is increased by pumping. The rubber stopper in the bottom outlet should be wired on permanently. This third bottle, C, is designed to serve

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† Now residing in Rochester, Minn.

as an irrigating bottle and it will be readily understood that pumping air into the bottle from above will tend to force fluid at a regulated pressure out of the bottom outlet.

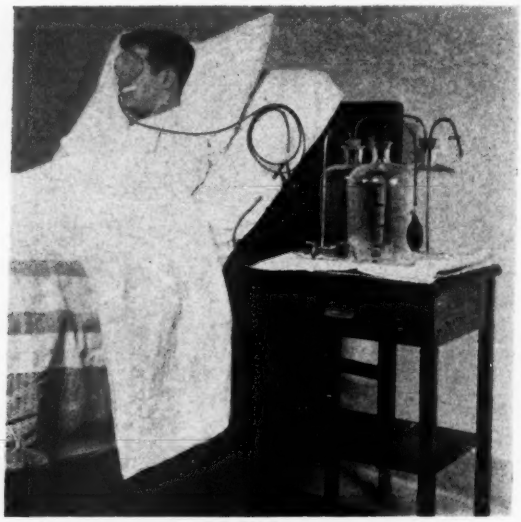

FIG. 2. Illustration showing the use of the suction-irrigation apparatus.

At F is an easily operated three-way valve or stop-cock which connects the vacuum bottles to the irrigating bottle, and all three in turn to the gastrointestinal tube. This valve is of the type to be found in any auto supply store and is designed to connect an extra gas tank to a feed line. The operation of this valve is quite simple for, by turning its handle clock-wise, the vacuum bottles are permitted to suck on the gastrointestinal tube. When the handle is turned in the opposite direction, the irrigation bottle may be operated. If the handle is turned midway between the extremes of these two positions, the valve will be closed entirely.

The apparatus seems to have most satisfactorily demonstrated that it has eliminated most, if not all, of the serious disadvantages peculiar to the standard Wangensteen apparatus. Indeed, the effect of the irrigating device is comparable to that of a lavaging agent and has been found most valuable in washing out the stomach in postoperative vomiting or in poison cases. In one case in which a patient was suspected of having swallowed iodine, a solution of starch water was placed in the irrigating bottle and the stomach thoroughly flushed even as the patient was vomiting.

Its most gratifying performances have been seen in connection with seven patients who were treated recently for intestinal obstruction by means of Miller-Abbott intubation. In these cases, all of its advantages over the old type of suction apparatus were most evident. Its ease of operation, efficiency and appearance are obvious at once. Moreover, the duration of its vacuum is about three to twelve hours, depending on how much material is present in the bowel and how actively the gastrointestinal tube and the bowel are irrigated. When the vacuum is exhausted, it is only necessary to connect the vacuum bottles to the nearest suction pump for about twenty minutes. The tubing is so arranged that the fluid previously sucked up in the bottles is drawn out along with the air so that it is not necessary to take apart the apparatus in any way in the course of re-evacuation.

Evacuation of the vacuum bottles is more rapid, especially if the amount of fluid in them is considerable, if the handle of the valve is turned to the suction position until all the fluid has been withdrawn.

Then the valve should be closed and the exhausting process continued for twenty minutes.

2 4-liter vacuum bottles	$2.20
1 4-liter irrigating bottle	1.50
1 three-way valve and bushings	2.20
1 sphygmomanometer bulb	2.25
3 ft. ¼ inch copper tubing	.30
3 ft. rubber tubing	.30
1 Hoffman clamp	.17
rubber stoppers	.30
	$9.22

The suction exerted by the freshly evacuated bottles can be easily regulated as desired, by manipulating the three-way stop-cock so that no damage can occur to the mucosal surface of the bowel by too great a pull. (Fig. 2.)

The approximate cost of the materials used in making this apparatus are listed in the accompanying table.

Many of the above items need not be purchased new, but will be found handy about a hospital laboratory. Most of the materials will never need replacement so that there is a minimum of upkeep. It has been found that rimming the rubber corks with collodion or rubber cement will produce an excellent seal which need not be broken until the apparatus requires cleansing.

Duplications (of the alimentary tract) are spherical or elongated hollow structures which possess a coat of smooth muscle, which are lined by a mucous membrane, and which are intimately attached to some portion of the alimentary tube. They may appear at any level from the base of the tongue to the anus. They are more commonly found in relation to the small intestine than to any other part of the gastro-intestinal tract.
From—"Abdominal Surgery of Infancy and Childhood"—by William E. Ladd and Robert E. Gross (W. B. Saunders Company).

GREATER DESCRIPTIVE ACCURACY AT THE OPERATING TABLE*

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IT is obviously desirable to have measurements of the size of various pathological lesions encountered in the course of operations. In such circumstances, the size is ordinarily estimated by eye, with an accuracy dependent upon the individual. Size is frequently expressed in terms of familiar objects, a method which has evident disadvantages due to variations in the size of the objects used as a standard. Complicating the operating kit by inclusion of an extra article for the sole purpose of measuring (such as a conventional ruler), which may not be needed, also has drawbacks. One object which lends itself to use as a measure, however, is almost invariably among the operating instruments, namely, the scalpel, the handle of which may be marked with the metric scale, either throughout its length or the fine markings limited to a portion of the handle with a notation as to the total length up to the point at which the blade is inserted. Both methods of marking are illustrated. (Fig. 1.)

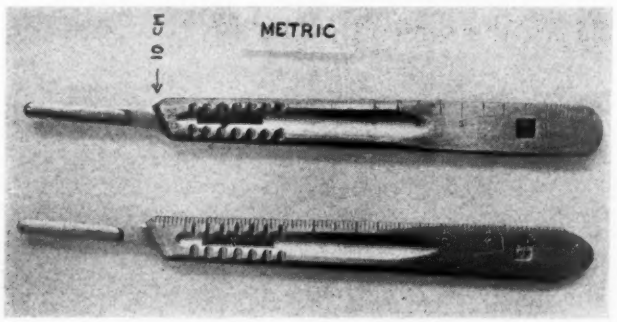

FIG. 1. Scalpel handles marked with metric scale, the lower one throughout its entire length, the upper one for a distance of 5 cm. It will be noted that the total length of the handle to the point of insertion of the blade is 10 cm.

The cost of engraving marks on the handles of scalpels is relatively high; but if there were a widespread demand it is likely that they could be stamped on, easily and inexpensively, during the process of manufacture.

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A NEW BREECH FORCEPS

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THIS instrument, which I have been using on all cases of breech delivery for several years, I believe is an entirely new type of forceps. After repeated remodeling it now seems satisfactory. The cut is self explanatory. The idea is to apply the forceps *over* the child's body instead of *under*. Also the curve of the instrument allows the sweep up and over the pubis without hindrance from the baby's body.

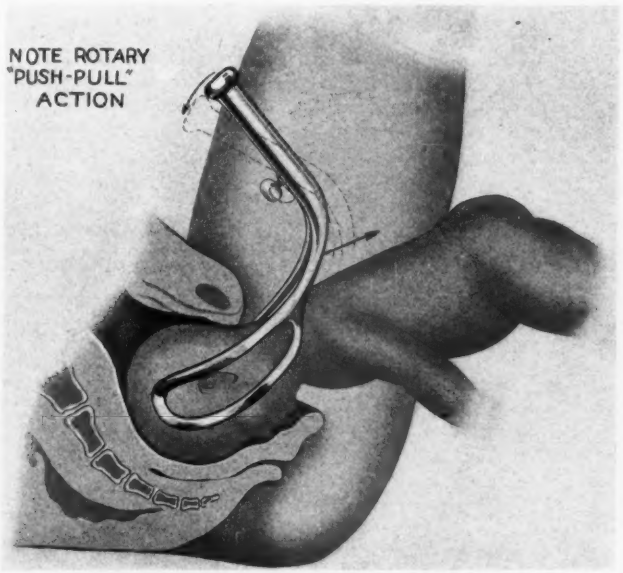

FIG. 1. The general shape of the blades is similar to the Elliot pattern. The handles fit together with a swivel action. The two blades are detached for application as in the regular forceps. When applied to the baby's head, the blades are locked together by a thumb set. When locked together they stay set in proper position. Note curve in handles to fit over the pubis. The spread of blades at the tip is from three inches down.

The patient should be in the lithotomy position down to the edge of the table. I prefer that both feet be delivered first and together. This can be done at any stage of delivery, even though the buttocks show at the vulva, provided the patient is under full anesthesia. To attempt this without full anesthesia and before the cervix is fully dilated invites a fractured femur or humerus. With the hand well lubricated with heavy green soap (thin soap is a mistake) the buttocks can be pushed back up into the well relaxed uterus and the feet easily brought down. After both arms are delivered allow the baby's body, face down, to drop down over the edge of the table. At this stage, with the old type forceps, the doctor's troubles really begin, trying to adjust the blades under the body, with only a few minutes to go.

With this new type, forceps application is no more difficult than with ordinary cephalic position. Apply exactly the same method. The blades lock together with the thumb set. They cannot spring apart. There is no need to hold them by hand

grip and it is impossible to injure the head by hand pressure, because no matter how firmly you grip the handles there is positively no pressure on the blades. Grasp the middle of the curve with one hand and pull. The other hand pushes the top of the handles up and over the mother's abdomen as the head emerges. At the same time the baby's body is tilted up over the pubis to follow the forceps. Do not pull on the handles. That would tilt the blade tips up against the bladder. As this curve is maneuvered the face follows on the same principle as when we pull with a finger in the baby's mouth. This tilting brings the baby's mouth free at the vulva. There is no need to hurry now, because the baby can breathe, and there is no need to injure the neck or brachial plexus.

THE appendix of the child is larger in relation to the size of the abdominal cavity than is that of the adult, and the mesoappendix is correspondingly longer and less fixed. Therefore, the *point of maximal tenderness* may vary more in location than it does in the adult. It may appear near the midline, well down in the pelvis, or even out in the right flank.
From—"Abdominal Surgery of Infancy and Childhood"—by William E. Ladd and Robert E. Gross (W. B. Saunders Company).

A USEFUL AID IN THE MANAGEMENT OF COLOSTOMIES*

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THE care of a colostomy orifice has been greatly simplified in the past ten years, until now the average patient has little or no difficulty in handling a situation which formerly was greatly dreaded. The colostomy bag has been discarded by most surgeons, and in its place, simple pads, with proper training of the patient as to the care of the bowels, have made the so-called colostomy life anything but unpleasant to the patient and to those with whom he associates. Nevertheless, there is still much to be desired by the fastidious patient.

The useful aid to be described was devised by a very intelligent female patient of mine and, therefore, to her must and does go all the credit for its originality. A search of the literature fails to reveal any prior mention.

The accompanying illustrations show the technic of the device. The usual routine morning irrigation of the bowel is carried out. A vaginal tampax of appropriate size is selected. The tampax, with its outer covering, is introduced into the stoma of the bowel to a distance just sufficient to leave enough of the outer paper tubing to permit its withdrawal. Any protruding portion of the tampax is then further pushed into the opening until only the connecting string is left. A few layers of gauze or toilet paper over the colostomy complete the dressing. Under normal conditions, twenty-four hours may elapse before the dressing needs to be changed.

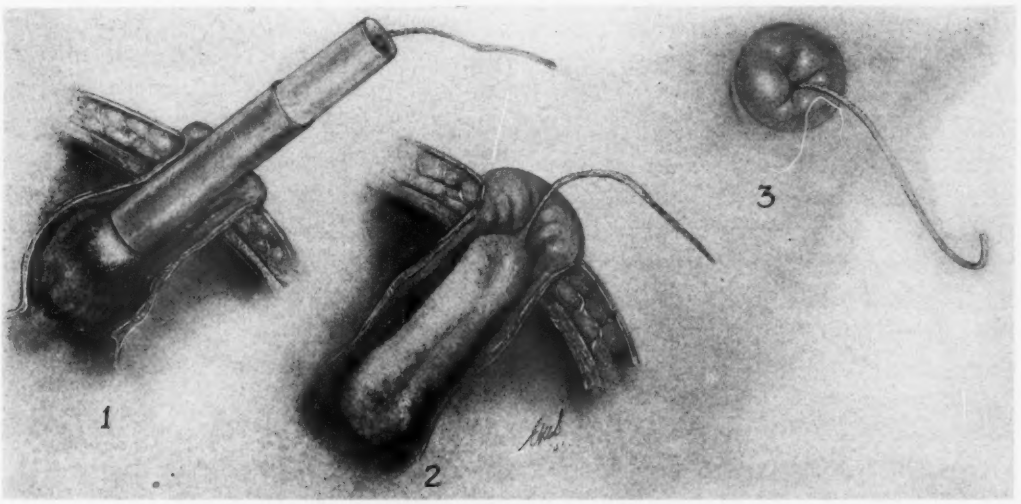

FIG. 1. 1, Tampon with outer covering being introduced into colostomy. 2, Tampon completely introduced. Outer covering has been removed. 3, Appearance of colostomy showing only attached cord protruding.

CONCLUSIONS

There is shown above, an inexpensive and most efficient aid for those obliged to lead a colostomy life. The normal moisture of the bowel causes the tampon to swell sufficiently to plug the colostomy firmly and prevent any involuntary passage of flatus. The device is comfortable and the originator, my patient, leads an entirely normal life and would not consent to go back to the type of dressing she formerly used.

* From the Department of Surgery and the John C. Oliver Memorial Research Foundation at the St. Margaret Memorial Hospital, Pittsburgh.

Bookshelf Browsing

HUGH OWEN THOMAS*

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HUGH OWEN THOMAS was a most remarkable and interesting character, and a glimpse at his personality is as stimulating as a study of his professional achievements. He was born more than one hundred years ago in Wales. His father was a well established bone-setter practicing in Liverpool, the seventh in direct line of descent of followers of that work. At that time these practitioners, on the borderland of medicine, were not frowned upon as darkly as at present. Some of them were men of ability along certain lines, but their general knowledge of disease was very limited. Thomas said of them: "They knew nothing about diseases of the joints, and their treatment of joint disease was utterly wrong." That Thomas' father saw the doom of the bone-setters is evidenced by the fact that his five sons all became qualified surgeons. However, Thomas learned many things from his father who was a conservative and conscientious worker.

At the age of seventeen Owen Thomas was apprenticed to his uncle, Dr. Owen Roberts of Wales. Dr. Roberts was a cultured and capable physician and prepared young Thomas for Edinburgh. After two years there Thomas entered University College, London, and graduated in 1854, becoming a member of the Royal College of Surgeons. He then studied in Paris for a few months.

Thomas began practice as assistant to his father, and it was this connection that caused the medical men of Liverpool to consider him outside of the fold. Father and son, the former stubbornly conservative, the latter always imaginative, soon clashed and in 1858 Owen Thomas left his father and started practice independently. It was not long before he had a very considerable following, and opened the now famous office at 11 Nelson Street. Robert Jones used this office throughout his life, and it is now occupied by Mr. T. P. McMurray. This office was near the dock yards and warehouses, and from them Thomas received many cases of fractures and dislocations, so that he had ample material for observation of such injuries. The families of the workmen provided him with a large general practice. He labored constantly in their interest and no man ever had a more devoted and loyal following. He said one time that he "would rather treat a poor patient than a rich one, as the poor man added to his prestige while a rich man paid him a fee, but was not as apt to follow his instructions and thus ran away with his reputation."

Thomas had an original, investigative mind and was not content to take things for granted. Authority as such meant nothing to him unless authority's claims were proved by his own experience. Every case was a problem, and he labored to solve it with intense devotion. Robert Jones says of him that "he had an orderly mind and a prodigious memory," so he was well equipped to classify his cases and draw accurate conclusions as to his treatment. Added to this was his rare inventive genius,

* Address delivered at the Clinical Congress, New Haven, September, 1936.

which provided him with the apparatus to carry out his ideas. The *British Medical Journal* states that the appliances he invented and perfected have never been improved upon. One is impressed on looking through his books to find illustrated pieces of apparatus that are generally thought to be of recent origin. He seems to have anticipated everything in the way of splints and even the Balkan frame.

We generally think of Thomas as an orthopedic surgeon. As a matter of fact he carried on a general practice and had more than a local reputation as an operator for stone. Here again he devised an improved procedure and invented special instruments for carrying it out. He was one of the first to advocate the fresh air treatment of tuberculosis and he did pioneer work in the treatment of paralyzed muscles and nerve injuries.

Frederick Watson who has written "The Life of Sir Robert Jones," devotes considerable space to Dr. Thomas and says of him: "He knew more about diseases of the bones and joints than any living man, and had the largest practice of its kind in the world."

Thomas never had a public hospital appointment but his large practice provided him a wealth of material. He had a small hospital near his office, and on his own premises had a blacksmith shop and a smithy who made most of his apparatuses. The greatest part of his work was done in his office. Here fractures and dislocations were reduced, splints applied and the patients sent home. Robert Jones tells how Thomas would reduce old dislocations of the shoulder without an anesthetic, also of lithotomies performed with the patient lying on the office floor and without anesthesia, of seeing Thomas perform at least a thousand tenotomies for club foot, with as he says, what we would now consider most inadequate preparation, yet he never saw a case in which suppuration occurred.

Thomas was forever in search of basic principles upon which to establish his methods of treatment. He said, "To me it appears an anomaly that the surgeon should have to make a choice of theories. The principles of treatment should not be left to the discretion of the surgeon, but should be unalterable. The theory must first be settled and the mechanics will right themselves." To his mind the principle of rest was the dominant factor in recovery from disease, and his ingenious splints and braces were designed to carry out his idea most efficiently. He had been impressed while a student with the great number of amputations that were done for joint disease, and he set himself to devise a plan of treatment to cure the disease and save the limbs. His success in so doing is one of the most brilliant pages of surgical history. His well known splint is credited with saving innumerable limbs and lives during the World War. British Army statistics show that before the introduction of the Thomas splint 80 per cent of patients with compound fractures of the femur died. When immediate fixation in a Thomas splint was done Bowlby says this mortality was cut to 20 per cent.

In 1874, Thomas began experimenting to find a method of stimulating callus formation in cases of delayed union. At first he used percussion over the seat of fracture with a felt-padded hammer, but about 1880 he introduced a method that he called damming the circulation. He did this by tying pieces of rubber tubing above and below the fracture site. Sir Robert Jones tells of the visit of a famous German surgeon who was much interested in this form of treatment, and later published the method, but allowed his readers to infer that he was the originator of it. In 1889, Robert Jones reported forty-five cases of fracture of the neck of the femur that Dr. Thomas had treated by producing artificial impaction through pounding on the trochanter with a felt-protected mallet.

Dr. Thomas was accorded scant recognition by his British colleagues but his work attracted considerable attention in foreign countries and in the eighties he had many visitors from the continent and the U. S.

Those who saw his work and his results became firm followers of his teaching. The lack of appreciation at home may have been due in part to his association with his bone-setter father and his fearless attacks on false theories and practices no doubt also played their part. Always tolerant of criticism himself, he criticized outspokenly whatever he knew to be fallacious. In a criticism of Dr. Sayre's book he quotes from Dr. Sayre's preface: "It contains many expressions that I would like to change," and says, "It was Dr. Sayre's duty as a public teacher to change anything of the correctness of which he had a doubt." Thomas never published anything until he believed that he was on solid ground. The *British Medical Journal* states, "Of no man can it be more truly said that time has justified his teaching and practice." In a letter to Dr. Gibney he closes by saying, "I remain one able and contented to be weighed in the balance of the future." His severe criticism of nearly everyone may have been done in all honesty and was probably due to his burning zeal, but to call it blunt would be putting it mildly. Writing of the treatment of Madame Dudevant (George Sand) he says, "To this most painful, irrational, and useless procedure the elite of the profession in France were consenting parties, Madame Dudevant would have had a far better chance of recovery had no medical aid been sought for her." Discussing the report of a case of a child with intussusception treated by insufflation he wrote, "The child would have recovered sooner if no medical aid had been obtained—he luckily tided over both that and the local difficulty." Again he wrote, "Mr. Coley reports the operation, paracentesis, was performed with a trocar one sixth of an inch in diameter, but from the quality of the fluid that followed the gaseous discharge, it must have been one-fourth of an inch at least." Here without any personal knowledge of a performance he disputes the operator's report on the size of the instrument used. He was equally outspoken in his praise of anything that met with his approval. Speaking of a volume by Von Niemeyer he says, "No criticism of mine can do justice to its merits, nor to the trenchant manner with which he brings conviction to the mind of the reader." Of Sydenham, he says, "He seems to have come to the same conclusions as myself."

In 1873, Thomas published his first surgical work. This was on "Fractures of the Lower Jaw." The treatment he described and advocated is practically the same as that carried out today. To facilitate the operation he had devised an ingenious device for tightening or loosening the wire.

Rushton Parker became his friend and advised and encouraged him to publish his methods, so from 1873 until his death he published several books and many pamphlets, dealing with diseases and injuries to the bones and joints. At the time Thomas was working, Lister was perfecting his great innovation. Thomas wrote, "On the publication by Prof. Lister of his successes I at once commenced the practice of antiseptic surgery and continued to practice it with the result of being perfectly satisfied that its merits have not been overstated, nor the trouble necessary for carrying out the details exaggerated." Dr. Ridlon told me that while he saw Dr. Thomas working in clean aprons, one of the great hospital surgeons of England was using a discarded spring overcoat as an operating gown. This was only fifty years ago.

The amount of work done by Thomas is almost unbelievable. He told Dr. Gibney who visited him in the late eighties, that he saw one hundred patients a day, and two hundred on Sundays, a day he devoted to a free clinic. Dr. Ridlon who was the first American surgeon to visit Thomas counted 146 patients in the office in one day.

He showed evidence of careful reading of past as well as current medical writings and discussed them freely.

His intense interest and great industry is shown in the notes he made daily from the

newspaper reports of the illnesses of prominent persons. In the case of Leon Gambetta Thomas says, "His death was a subject of keen interest to the inhabitants of the civilized world." . . . He kept a chart of the patient's daily progress made up from the reports of Gambetta's physicians and in this chart Thomas discusses the treatment and gives his views as to its value. To quote, "Dec. 10. Further aggravation of abdominal symptoms, and during the night whilst M. Gambetti made an effort to visit the water closet, he felt a pain in the right hypograstic region, which hindered his sleeping and was present in the morning. This day Professor Charcot visited him and prescribed an anema; no tympany. It was proposed to apply counter-irritation to the seat of pain, but ultimately a laudanum compress was substituted.

"Dec. 31st. Night quiet, but low slight delirium, slightly conscious up to a quarter to 11 P.M. when he died." Thomas goes on, "The post mortem revealed the following facts—The termination of the ileum was found so much contracted that the finger could hardly be passed into it," etc., possibly a case of regional ileitis.

He likewise recorded the progress of President Garfield's illness keeping daily notes from "July 2nd. 1881 (mid-day) Pulse 52 time of accident but recovered to 63 shortly after, at 3 P.M. pulse 112, vomited 4:30." On September 19, he notes, "situation critical: chilled, pulse 143 feeble, towards evening pulse 104, temperature 91—Death."

When one of his horses became ill he took complete charge of its care, and recorded the daily symptoms and treatment in minute detail. To quote, "8th. day, 10 A.M.—Not in pain, as far as objective symptoms show; will not get up; had been lying some hours; got up at 10:30, but lay down again; now gave ten grains of morphia under the skin, and a gallon of oatmeal gruel; she also drank at 12 noon a bucketful of water, and rose up making signs for her usual food, and appeared all right. When lying down the skin of the abdomen was in folds, showing that there was no distention; pain returned. At 6 P.M. gave twelve grains of morphia. At 12 midnight gave fourteen grains of morphia—gave this large dose as the former doses appeared to lose their effect too soon. 15th. day, 10 A.M.—Found her on her back with very evident signs of pain. Some friends that were with me assured me she was dying; my previous experience informed me otherwise; gave twenty grains of morphia under skin; and in forty minutes she was up and apparently well. Her diet this day was limited to strong linseed tea and cold water, of which she took about a gallon. Twenty grains morphia repeated at 2 P.M., and again at 12 midnight, relieved all pain, so that during this day she gave no further signs of distress." This he kept up for thirty-four days and when his horse died, recorded the autopsy findings and then discussed the condition and progress of the disease with the results of treatment as compared to intestinal disease in the human. The completeness of these notes would do credit to any hospital records of today.

It is to Sir Robert Jones that we are indebted for most of our knowledge of Thomas' personality, and he was also instrumental in introducing Thomas' methods to the profession at large. Through his tact and ability he bridged the gulf between Thomas and his colleagues. Robert Jones was Thomas' nephew, and went to live with him at the age of fifteen. After graduating in medicine at twenty-one he joined his uncle as assistant at 11 Nelson Street in 1878, and was in intimate contact with him until Thomas' death. He refers to Thomas in the highest terms of affection and admiration.

In his Thomas Memorial Address Jones described a day's work of Dr. Thomas which sums up as follows: Starting at six he would make ten or twelve calls before breakfast. From nine to two he saw patients in his office. The afternoon was devoted to operating and visiting patients. After dinner he had patients till eight or nine,

His evenings were devoted to designing and making instruments or writing and reading. This routine Thomas kept up for over thirty years with never a vacation. To be always in action was his creed. How in the midst of such professional activity the man found time for other fields of endeavor is a mystery. Yet he was a student of history, theology and Egyptology and had some engineering knowledge. He was fond of music and devoted Sunday nights to home concerts.

Thomas was a slightly built man about 5 ft. 4 in. in height. He was never in robust health but seemed to carry on in spite of bodily ills. He was quick in his actions but exact in his work. Kind and generous, he was greatly loved and admired not only by his patients but by visiting doctors as well. He always wore a closely buttoned black coat and a peaked cap which protected an injured eye from the light. He smoked cigarettes almost constantly and kept a bureau drawer in his office filled with them.

Undoubtedly, Dr. Thomas shortened his life by overwork. He had often expressed to his wife the desire to die in harness and it was thus that he passed away. In January, 1891, he was attacked by pneumonia and died within a week. He was then fifty-seven years old. Robert Jones asks, "What might not such an active brain as his have developed had it been given longer life?"

It is generally acknowledged that Thomas has earned a place with the great surgeons of all times. His work speaks for itself, while the work of most of his contemporaries has been forgotten.

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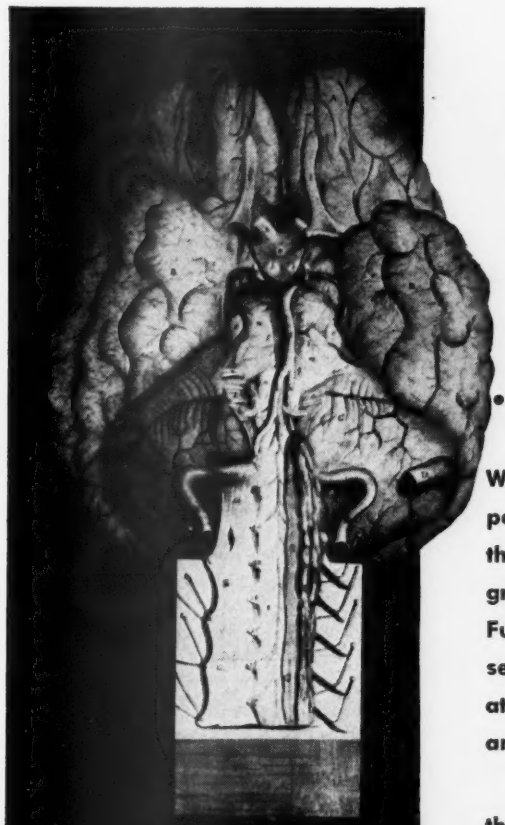
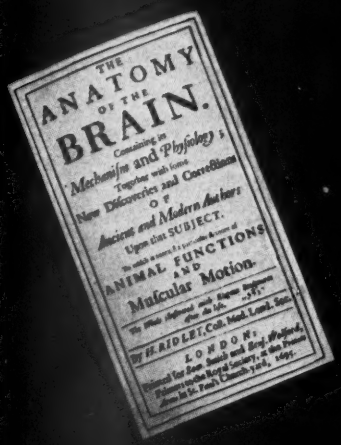


From the "elegant sculptures after the life" which are found in that classic anatomical volume of 1695, credited to H. Ridley—"The Anatomy of the Brain."



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1. Council Report: J.A.M.A., 113: 1734, 1939
2. Merritt, H. H. & Putnam, T. J.: A. J. Psychiat., 96: 1023, 1940

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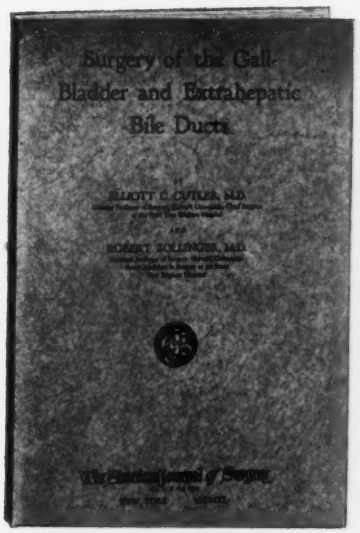

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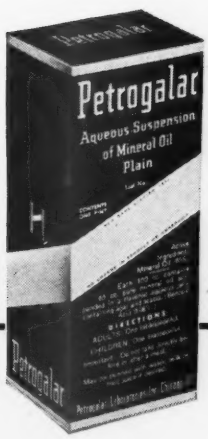

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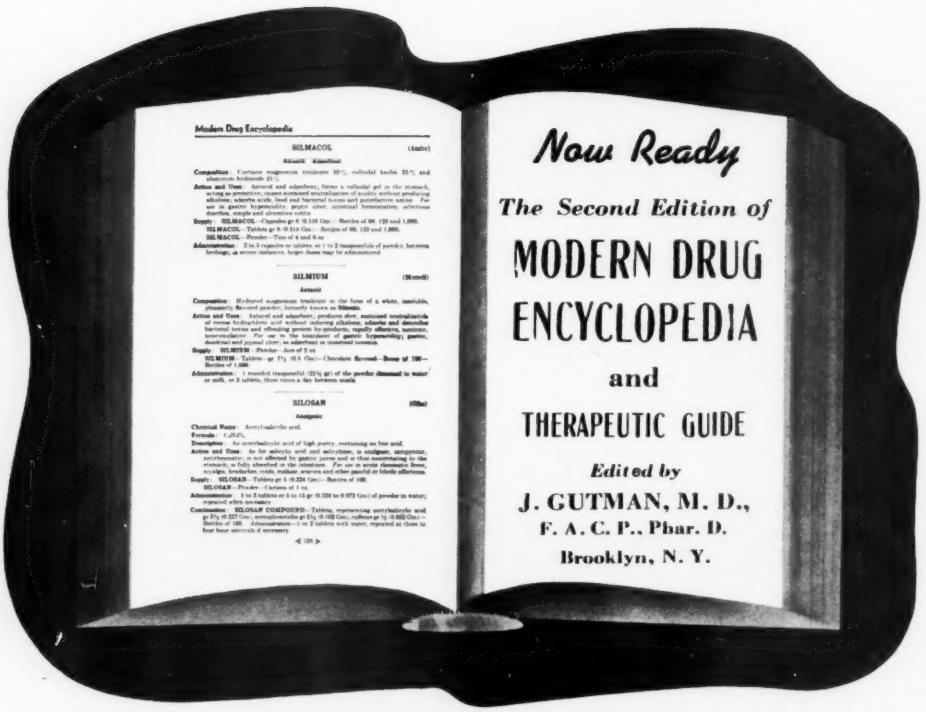

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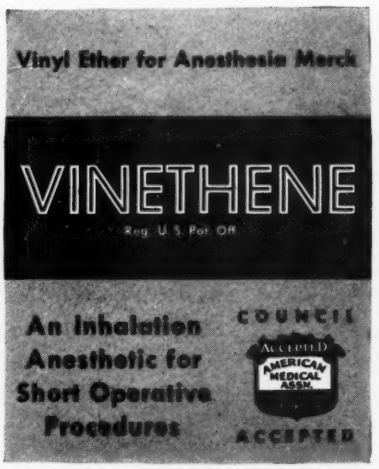

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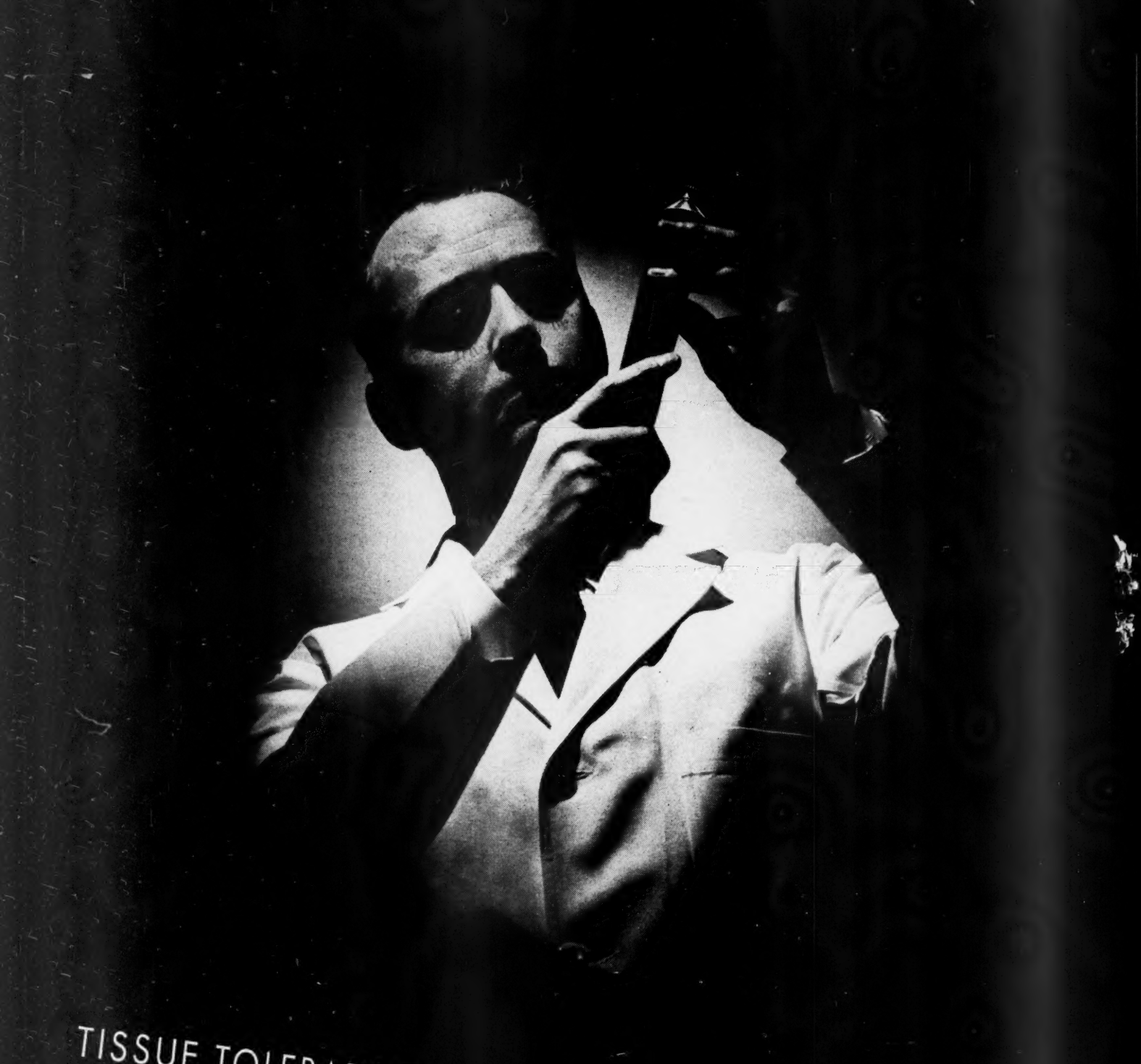

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Instruments and Apparatus

Austenal Laboratories, Inc	*December*
Bard-Parker Co., Inc	*November*
Crescent Surgical Sales Co., Inc	7
General Electric X-ray Corp	19
Fred Haslam & Co., Inc	28
Parker, White & Heyl, Inc	*November*
Picker X-ray Corp	*November*
Geo. P. Pilling & Son Co	11
J. Sklar Manufacturing Co	9
Edward Weck & Co., Inc	5

Sutures

Davis & Geck, Inc	*Insert facing 2nd Cover*
J. A. Deknatel & Son, Inc	*November*
Johnson & Johnson	20

Pharmaceuticals

Abbott Laboratories	10
Alba Pharmaceutical Co., Inc	*December*
American Hospital Supply Corp	6
The Armour Laboratories	*December*
Baxter Laboratories, Inc	6
Ernst Bischoff Co., Inc	1
Chatham Pharmaceuticals, Inc	*December*
Ciba Pharmaceutical Products, Inc	*4th Cover*
Cutter Laboratories	21
Hoffmann-La Roche, Inc	2
Hynson, Westcott & Dunning, Inc	30
The Lavoris Company	30
Lederle Laboratories, Inc	18
Thos. Leeming & Co., Inc	*December*
E. C. Lientz & Co., Inc	28
Eli Lilly and Company	35
Merck & Co., Inc	34
National Drug Co	13
Ortho Products, Inc	36
Parke, Davis & Co	23
Petrogalar Laboratories, Inc	31
Schering & Glatz, Inc	*December*
G. D. Searle & Co	17
E. R. Squibb & Sons	16
Frederick Stearns & Co	*December*
United Drug Co	8
The Upjohn Co	*November*
Wm. R. Warner & Co., Inc	12, 22
Winthrop Chemical Co., Inc	25
John Wyeth & Bro., Inc	*November*

Hospital Supplies

American Hospital Supply Corp	6
Baxter Laboratories, Inc	6
Becton, Dickinson & Co	*December*
Crescent Surgical Sales Co., Inc	7
Cutter Laboratories	21
Duke Laboratories, Inc	27
General Electric X-ray Corp	19
Fred Haslam & Co., Inc	28
Johnson & Johnson	*December*
Macalaster Bicknell Co	*December*
Massillon Rubber Co	27
Picker X-ray Corp	*November*
J. Sklar Manufacturing Co	9

Post-Graduate Instruction

Cook County Grad. Sch. of Med	24
N. Y. Polyclinic Med. School	24

Foods

The Wander Company	33

Miscellaneous

The American Journal of Surgery	14, 15, 29
General Information	4
Iodine Educational Bureau, Inc	*December*
New Modern Drugs	32
Society Meetings	26

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